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RESEARCH MEMORANDUM

for the

Bureau of Aeronautics, Department of the Navy

STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF AN 0.065-SCALE MODEL OF THE CHANCE VOUGHT XRSSM-N-9a (REGULUS II) MISSILE AT MACH NUMBERS FROM 1.60 TO 2.00 (TED NO. NACA AD 3122)

By William R. Hofstetter

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NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS

WASHINGTON

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STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF AN 0.065-SCALE MODEL OF THE CHANCE VOUGHT XRSSM-N-9a (REGULUS II) MISSILE AT MACH NUMBERS FROM 1.6 TO 2.0 (TED NO. NACA AD 3122)

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ABSTRACT

The static longitudinal and lateral stability characteristics of an 0.065-scale model of the XRSSM-N-9a (Regulus II) guided missile and its components have been determined for a Mach number range of 1.6 to 2.0 at a Reynolds number per foot of 2.0×10^6.

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Missiles - Components in Combination	1.7.2.1
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Stability, Longitudinal - Static	1.8.1.1.1
Stability, Lateral - Static	1.8.1.1.2
Control, Directional	1.8.2.3

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STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF AN 0.065-SCALE MODEL OF THE CHANCE VOUGHT XRSSM-N-9a (REGULUS II) MISSILE AT MACH NUMBERS FROM 1.6 TO 2.0 (TED NO. NACA AD 3122)

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SUMMARY

An investigation has been conducted to obtain the static longitudinal and lateral stability characteristics of an 0.065-scale model of the XRSSM-N-9a (Regulus II) guided missile. Rudder effectiveness was also determined. Data were obtained at Mach numbers of 1.6, 1.8, and 2.0, at a Reynolds number of 2.0×10^{6} per foot.

Results of the investigation indicate that a large positive change in the pitching moment at zero lift will be incurred when an antibuzz screen is extended in front of the engine duct inlet. These positive moments are overcompensated for by a simulated free-floating canard trimmer.

Static directional stability was found to decrease markedly beyond an angle of attack of 5.5° at all Mach numbers tested. The missile becomes unstable between 5.5° and 11°. Incorporation of ventral fins will maintain static directional stability to an angle of attack of 11°.

INTRODUCTION

The XRSSM-N-9 (Regulus II) guided missile, in the course of its development, has been the subject of a number of wind-tunnel and free-flight investigations. As a result of these investigations, a canard trimmer was incorporated (ref. 1) to eliminate the large negative pitching moment at zero lift which existed with the original configuration. In addition, previous investigations have considered the effects of mass-flow and boundary-layer bleed variation, control effectiveness (ref. 2), and dynamic stability (ref. 3).

Subsequent to the foregoing work the configuration was further modified to incorporate a lar[redacted]er. In addition, the

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wing was located farther aft, the vertical tail enlarged, and the inlet and fuselage afterbody modified. The latter changes were made to provide improved longitudinal and directional stability characteristics and to allow greater flexibility in engine selection.

At the request of the Bureau of Aeronautics, Department of the Navy, an investigation was conducted in the Ames Unitary 9- by 7-foot wind tunnel (ref. 4). The purpose of the investigation was to determine the static longitudinal and directional stability characteristics of the modified configuration (XRSSM-N-9a) of the missile. The results of the investigation are reported herein. Included are the effects of the canard trimmer, antibuzz screen, ventral fins, rudder deflection, and mass-flow ratio through the engine duct.

COEFFICIENTS AND SYMBOLS

Force and moment coefficients are referred to the stability axes, with the exception of the base drag, which is referred to the body axes. Moments are taken about the point of intersection of the fuselage reference axis and the projection of the leading edge of the wing mean-geometric chord. Systems of axes and positive direction of forces, moments, and angles are shown in figure 1.

A_b base area, sq ft

A_c inlet capture area, sq ft

b wing span, ft

$\bar{c}$ mean geometric chord, ft

M_∞ free-stream Mach number

p_b base pressure, lb/sq ft

p_∞ free-stream static pressure, lb/sq ft

p_t total pressure, lb/sq ft

q free-stream dynamic pressure, lb/sq ft

R Reynolds number

S total wing area, sq ft

C_L lift coefficient, $\frac{\text{lift}}{qS}$

C_D drag coefficient, $\frac{\text{drag}}{qS}$

C_{X_b} base drag coefficient, $\frac{(p_\infty - p_b)A_b}{qS}$

C_Y side-force coefficient, $\frac{\text{side force}}{qS}$

C_m pitching-moment coefficient, $\frac{\text{pitching moment}}{qS\bar{c}}$

C_n yawing-moment coefficient, $\frac{\text{yawing moment}}{qSb}$

C_l rolling-moment coefficient, $\frac{\text{rolling moment}}{qSb}$

C_{m_o} pitching-moment coefficient at zero lift

a.c. aerodynamic center, percent $\bar{c}$

C_{n_β} rate of change of yawing-moment coefficient with sideslip angle, $\frac{\partial C_n}{\partial \beta}$, per deg

C_{l_β} rate of change of rolling-moment coefficient with sideslip angle, $\frac{\partial C_l}{\partial \beta}$, per deg

$C_{n_{\delta_R}}$ rate of change of yawing-moment coefficient with rudder deflection, $\frac{\partial C_n}{\partial \delta_R}$, per deg

$\frac{m}{m_\infty}$ duct mass-flow ratio based on inlet capture area, A_c

α angle of attack of fuselage reference axis, deg

β angle of sideslip of fuselage reference axis, deg

δ_R rudder deflection, deg

MODEL

The model tested was an 0.065-scale model of the XRSSM-N-9a (Regulus II) guided missile furnished by the manufacturer, Chance Vought Aircraft, Incorporated. Geometric characteristics of the model are

listed in table I. Photographs of various test configurations are shown in figure 2. Details of the model and components are shown in figures 3 and 4.

The model was equipped with an inlet and engine ducting system to enable simulation of engine air flow through both a main duct and boundary-layer bleed duct. Internal lines of the main duct were true scale for approximately three diameters behind the duct lip. The boundary-layer bleed duct was true scale except that the center bleed channel, normally used for air-conditioning purposes, was bled into the main duct.

TEST PROCEDURE

Pitch runs were made through an angle-of-attack range from -12° to $+12^{\circ}$ at zero angle of sideslip. Yaw runs were made through an angle-of-sideslip range from $+2^{\circ}$ to -8° at nominal angles of attack of -5.5°, 0°, $+5.5^{\circ}$, and $+11^{\circ}$. Test data were taken at Mach numbers of 1.60, 1.80, and 2.00 at a Reynolds number per foot of 2.0×10^{6}.

Forces and moments were measured by use of an internally mounted, six-component, strain-gage balance. Base static pressure, balance-chamber static pressure, main-duct static pressure, and main-duct total pressure were obtained from pressure taps.

Corrections were applied to both angle of attack and angle of sideslip to take account of stream angle and sting and balance deflection under load. Rudder deflection due to load was not known; accordingly, no corrections were applied. Longitudinal-force measurements were corrected for base and balance-chamber drag by adjusting the local static pressure to free-stream static pressure, and for buoyancy.

Precision of the test results is indicated by the number of significant figures to which the basic data are presented in tables II and III.

RESULTS

Results of the present investigation are shown in the form of graphs and tables. Plots of the longitudinal-stability parameters, C_{m_0} and a.c., and the lateral stability and control parameters, C_{n_β} C_{l_β}, and $C_{n_{\delta_R}}$, are presented for discussion and interpretation. A few basic-data plots are included only for the purpose of illustrating

typical variations of the longitudinal and lateral characteristics of the basic configuration. The foregoing graphs and plots are presented in figures 5 through 11. The basic data are presented in tabular form, the pitch characteristics in table II and the sideslip characteristics in table III.

DISCUSSION

Longitudinal Stability

Basic model.- Typical longitudinal characteristics of the basic configuration are presented in figure 5. The variations indicated are representative of those obtained for the basic configuration at all three test Mach numbers. It will be noted that the pitching-moment curve is nonlinear. Correspondingly, the aerodynamic center would undergo a shift of approximately 0.2 percent of the mean geometric chord over the range of lift coefficients tested. Also shown in figure 5 are the results obtained in reference 1 for a configuration similar to that of the present test. It should be noted that the model of reference 1 utilized a more forward wing location and had a smaller trimmer mounted at a higher angle of incidence[1] than did the present model.

Effects of changes in configuration.- The variations with Mach number of C_{m_o} and a.c. for the configurations tested are presented in figure 6. A summary of the results at Mach number 2.0 is given in the following tabulation:

Configuration	C_{m_o}	a.c.
Basic	-0.004	0.10
Boundary-layer bleed closed	.002	.11
Trimmer off	-.030	---
Trimmer off, antibuzz screen extended	-.010	.24
Ventral fins on	.004	.12

The trimmer is intended to be free-floating during the terminal maneuver. In these tests it was not feasible to float the trimmer. Accordingly, the free-floating condition was simulated by removing the trimmer entirely. Furthermore, during the terminal maneuver of the missile the engine is shut off and the antibuzz screen is extended (to eliminate flow instability within the engine duct). As indicated by the preceding tabulation and figure 6, the removal of the trimmer overcompensates for the positive C_{m_o} shift that results when the

[1]The trimmer of reference 1 was mounted at an angle of incidence of 9.5° and had an exposed area of 1.28 square inches.

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antibuzz screen is extended. This, combined with a substantial rearward shift of the a.c. will give quite large negative pitching moments during the terminal maneuver.

Effect of Reynolds number.- The variation with Reynolds number of C_{m_0} and a.c. are shown in figure 7. Reynolds number effects are small in both cases.

Effect of mass flow.- The effect of mass-flow-ratio variation on C_m is indicated in figure 8. It is evident that changes in mass-flow ratio cause substantial changes in pitching moments. These changes must be considered when analysis is made of the flight characteristics of the missile during the various phases of its mission.

Lateral Stability

Basic model.- Figure 9 presents typical lateral characteristics of the basic configuration. The variations shown are representative of those occurring at all three test Mach numbers for the basic configuration.

Effects of changes in configuration.- The variation with Mach number of C_{n_β} and C_{l_β} for the configurations tested are presented in figure 10. A summary of the results at Mach number 2.0 and at an angle of attack of 0° is given in the following tabulation:

Configuration	C_{n_β}	C_{l_β}
Basic	0.0029	-0.0038
Vertical tail off	-.0098	-.0019
Ventral fins on	.0065	-.0030
Trimmer off	.0029	-.0037

As indicated by the preceding tabulation and figure 10, addition of ventral fins to the basic configuration results in a large increase in C_{n_β} and a decrease in C_{l_β}. Trimmer removal has negligible effect on both C_{n_β} and C_{l_β} at zero angle of attack.

Effect of angle of attack.- Examination of figure 10 indicates that for the basic and trimmer-off configurations, C_{n_β} decreases markedly beyond an angle of attack of 5.5°. With the center of gravity located at the leading edge of the mean aerodynamic chord, the missile will become directionally unstable between an angle of attack of 5.5° and 11°. Addition of ventral fins substantially increases C_{n_β}, maintaining directional stability up through an angle of attack of 11°.

Rudder effectiveness.- The variation with Mach number of $C_{n_{\delta_R}}$ is presented in figure 11. The basic test data indicate that C_n is a linear function of δ_R over the range of rudder deflections tested.

Ames Aeronautical Laboratory
National Advisory Committee for Aeronautics
Moffett Field, Calif., June 6, 1957

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TABLE I.- GEOMETRIC CHARACTERISTICS OF MODEL

Wing	
Total area (to center line), sq in.	88.20
Exposed area, sq in.	65.8
Span, in.	15.63
Aspect ratio	2.77
Taper ratio	0.60
Sweepback of quarter chord, deg	43.5
Dihedral, deg	0
Incidence, deg	0
Airfoil section, defined by: $\frac{t}{c} = 0.122496-0.015168\frac{x}{c}-\left[0.028768\left(\frac{x}{c}\right)^{2}-0.033096\left(\frac{x}{c}\right)+0.0150052\right]^{\frac{1}{2}}$	
Root chord (at center line), in.	7.08
Tip chord, in.	4.27
Mean geometric chord, in.	5.78
Fuselage	
Length, in.	44.53
Width (maximum basic diameter), in.	3.25
Depth, maximum, in.	5.05
Frontal area, sq in.	11.00
Fineness ratio	13.70
Vertical tail	
Total area (to center line), sq in.	27.08
Exposed area, sq in.	15.12
Span (to center line), in.	6.48
Aspect ratio	1.55
Taper ratio	0.32
Sweepback of quarter chord, deg	45.0
Airfoil section, same as wing	
Root chord (at center line), in.	6.27
Tip chord, in.	2.10
Mean geometric chord, in.	4.53
Rudder	
Area aft of hinge line, sq in.	3.22
Trimmer	
Total area (to center line), sq in.	5.40
Area exposed, sq in.	2.43
Span, in.	3.87
Plan form	Trapezoidal
Airfoil section	5-percent modified biconvex
Root chord (at center line), in.	2.00
Tip chord, in.	0.85
Incidence, deg	6.0
Ventral fins	
Area exposed, each, sq in.	3.07
Span exposed, in.	1.21
Angle with respect to vertical tail, deg	23.0
Sweep of leading edge, deg	60.0
Duct	
Inlet area, sq in.	2.62
Exit area, sq in.	2.81
Antibuzz screen	
Frontal area (screen only) sq in.	0.76

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TABLE II.- PITCH CHARACTERISTICS; $\beta = 0.2^o$, $\delta_R \cong 0^o$

(a) Basic model

α, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
M_∞ = 1.60; R/ft = 2.0x10⁶									
-0.1	-0.02	0.012	0.032	-0.01	0.003	-0.001	0.89	0.005	989
-.1	-.02	.014	.034	-.01	.004	-.001	.85	.004	984
-.1	-.03	.016	.039	0	.003	-.001	.71	.005	986
-.1	-.04	.021	.043	0	.003	-.001	.58	.005	987
-12.9	-.68	.125	.165	-.01	.003	.001	.86	.006	992
-10.7	-.57	.112	.121	0	.002	0	.88	.006	993
-8.8	-.47	.098	.089	0	.002	0	.88	.005	991
-6.6	-.36	.077	.062	0	.002	-.001	.89	.005	991
-4.4	-.25	.050	.043	0	.002	-.001	.89	.005	992
-2.2	-.13	.027	.033	0	.003	-.001	.89	.005	991
-1.1	-.07	.017	.032	0	.003	-.001	.90	.005	991
-.1	-.02	.012	.032	-.01	.003	-.001	.90	.005	991
1.0	.04	.007	.035	-.01	.004	-.001	.91	.004	991
2.1	.09	.002	.039	0	.003	-.001	.90	.004	991
4.3	.20	-.010	.056	0	.003	-.001	.91	.004	991
6.5	.32	-.025	.082	0	.003	-.001	.93	.004	991
8.7	.42	-.041	.115	0	.003	-.001	.91	.004	991
10.9	.53	-.054	.154	0	.002	0	.91	.005	991
13.1	.62	-.056	.197	0	.001	0	.90	.005	991
M_∞ = 1.80; R/ft = 2.0x10⁶									
0	0	.009	.026	-.01	.002	-.002	.98	.003	1057
0	-.01	.013	.027	-.01	.002	-.002	.93	.003	1062
0	-.02	.022	.034	-.01	.002	-.002	.77	.003	1059
-10.8	-.51	.095	.110	-.01	.004	0	.93	.004	1057
-8.7	-.40	.072	.078	-.01	.003	-.001	.94	.004	1057
-6.5	-.29	.055	.054	-.01	.002	-.001	.95	.004	1057
-4.3	-.19	.042	.037	-.01	.002	-.001	.95	.004	1057
-2.2	-.10	.028	.029	-.01	.002	-.001	.95	.003	1057
-1.1	-.05	.020	.028	-.01	.001	-.002	.97	.003	1057
0	0	.011	.029	-.01	.002	-.002	.98	.003	1057
1.1	.05	.004	.032	-.01	.001	-.002	.97	.003	1057
2.2	.10	0	.036	-.01	.002	-.002	.98	.003	1058
4.3	.20	-.012	.053	-.01	.002	-.002	.97	.003	1058
6.5	.31	-.026	.077	-.01	.001	-.002	.98	.003	1059
8.7	.41	-.038	.109	-.01	0	-.002	.95	.003	1058
10.9	.51	-.045	.145	-.01	0	-.002	.95	.003	1057
13.1	.60	-.046	.185	0	-.001	-.001	.95	.003	1057
M_∞ = 2.00; R/ft = 2.0x10⁶									
0	.01	-.005	.032	0	.002	-.001	1.00	.002	1149
0	.01	-.001	.032	0	.003	-.001	.99	.002	1149
0	-.01	.009	.035	-.01	.003	-.001	.81	.002	1149
0	-.01	.012	.041	0	.003	-.001	.63	.003	1149
0	.01	-.005	.033	0	.002	-.001	1.00	.002	1149
0	0	.006	.034	0	.003	-.001	.91	.002	1148
-13.0	-.59	.092	.147	0	.001	.001	.95	.003	1149
-10.8	-.49	.079	.107	0	.002	.001	.99	.003	1149
-8.6	-.39	.064	.076	0	.002	0	1.00	.003	1149
-6.5	-.29	.043	.054	0	.002	-.001	1.01	.003	1149
-4.3	-.19	.022	.039	0	.002	-.001	1.00	.003	1149
-2.2	-.09	.006	.033	0	.002	-.001	1.00	.002	1149
-1.1	-.04	0	.032	0	.002	-.001	1.00	.002	1149
0	.01	-.006	.033	0	.002	-.001	1.01	.002	1149
1.1	.06	-.009	.036	0	.002	-.001	1.00	.002	1149
2.2	.10	-.014	.041	0	.003	-.001	.99	.002	1149
4.8	.21	-.021	.057	-.01	.003	-.001	.97	.002	1149
6.9	.31	-.026	.079	0	.004	-.001	.95	.002	1148
9.1	.40	-.034	.107	0	.004	-.001	.96	.002	1148
11.3	.48	-.037	.139	0	.004	0	.95	.002	1148
13.4	.57	-.038	.179	0	.004	0	.96	.002	1148
0	.01	-.005	.032	0	.002	-.001	1.00	.002	1149
M_∞ = 2.00; R/ft = 1.2x10⁶									
0	.01	-.005	.035	-.01	.002	-.001	1.01	.001	704
-2.1	-.09	.006	.033	0	.002	-.001	1.00	.001	699
-1.1	-.04	0	.033	0	.002	-.001	1.00	.001	695
1.0	.05	-.010	.038	-.01	.003	-.001	1.02	.002	695
2.1	.10	-.014	.042	-.01	.003	-.001	1.00	.002	697
13.0	.56	-.040	.175	0	.003	0	.99	.002	702
M_∞ = 2.00; R/ft = 3.0x10⁶									
-2.3	-.09	.009	.030	0	.002	-.001	1.00	.003	1724
-1.1	-.04	.002	.030	0	.002	-.001	1.00	.002	1727
0	.01	-.004	.032	0	.002	-.001	1.00	.002	1727
1.1	.06	-.009	.035	0	.002	-.001	1.00	.002	1726
2.2	.10	-.013	.039	0	.002	-.001	.98	.002	1725
M_∞ = 2.00; R/ft = 3.6x10⁶									
-2.3	-.10	.011	.031	0	.002	-.001	.99	.002	2108
-1.2	-.04	.003	.030	0	.001	-.001	.99	.002	2108
0	.01	-.003	.031	0	.002	-.001	.99	.002	2108
1.2	.06	-.008	.034	0	.002	-.001	.99	.002	2107
2.3	.11	-.013	.040	0	.002	-.001	.98	.002	2106

(b) Boundary-layer bleed closed

α, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
M_∞ = 1.60; R/ft = 2.0x10⁶									
-0.1	-0.03	0.018	0.031	-0.01	0.003	-0.001	0.87	0.004	988
-.1	-.03	.018	.033	-.01	.003	-.001	.85	.004	991
-.1	-.04	.020	.037	-.01	.003	-.001	.73	.004	992
-.1	-.04	.023	.042	-.01	.003	-.001	.57	.004	991
-.1	-.03	.017	.030	-.01	.003	-.001	.86	.004	991
-12.5	-.66	.124	.160	0	.001	0	.83	.005	991
-12.5	-.66	.124	.159	-.01	.001	0	.83	.005	991
-10.3	-.56	.114	.117	0	.001	0	.85	.006	991
-8.1	-.45	.099	.082	0	.001	-.001	.86	.005	990
-5.9	-.34	.075	.057	-.01	.001	-.001	.87	.005	990
-4.4	-.26	.057	.043	-.01	.002	-.001	.86	.005	991
-2.2	-.14	.034	.032	-.01	.003	-.001	.86	.005	992
-1.2	-.08	.024	.030	-.01	.003	-.001	.87	.005	991
0	-.03	.017	.031	-.01	.003	-.001	.87	.004	991
1.0	.02	.010	.033	-.01	.003	-.001	.88	.004	991
2.1	.08	.005	.038	-.01	.003	-.001	.88	.004	991
4.3	.20	-.010	.055	0	.002	-.001	.88	.004	991
7.2	.34	-.031	.091	0	.002	-.001	.88	.004	991
9.4	.45	-.046	.127	0	.002	-.001	.87	.004	991
11.6	.55	-.057	.169	0	.001	-.001	.87	.004	991
13.8	.65	-.059	.214	0	0	0	.86	.005	990
M_∞ = 1.80; R/ft = 2.0x10⁶									
0	-.02	.019	.028	-.01	.001	-.001	.93	.002	1058
0	-.02	.021	.029	0	.001	-.001	.89	.003	1057
-.1	-.03	.024	.034	0	.001	-.001	.77	.003	1057
-.1	-.03	.028	.040	-.01	.001	-.001	.62	.003	1057
-12.4	-.59	.104	.145	0	.002	0	.87	.003	1058
-10.2	-.49	.092	.104	0	.003	0	.90	.004	1058
-8.0	-.38	.074	.073	0	.003	0	.92	.004	1058
-5.8	-.28	.060	.050	-.01	.002	-.001	.91	.004	1058
-2.2	-.12	.039	.028	-.01	.001	-.001	.91	.004	1059
-1.1	-.07	.029	.027	-.01	.001	-.001	.92	.004	1058
0	-.02	.020	.027	0	.001	-.001	.93	.003	1058
1.2	.03	.011	.030	0	0	-.001	.94	.003	1058
2.2	.08	.006	.034	0	0	-.001	.93	.003	1058
4.3	.18	-.006	.050	-.01	.001	-.001	.95	.003	1058
7.2	.32	-.024	.083	0	0	-.001	.94	.003	1058
9.3	.42	-.036	.116	0	0	-.001	.93	.003	1058
11.5	.51	-.045	.154	0	.001	-.001	.93	.003	1058
13.7	.60	-.044	.195	0	0	0	.92	.003	1058
M_∞ = 2.00; R/ft = 2.0x10⁶									
0	0	.002	.031	-.01	.002	-.001	.99	.003	1149
0	0	.004	.033	-.01	.003	-.001	.97	.002	1149
0	-.01	.010	.037	-.01	.003	-.001	.82	.002	1149
-.1	-.01	.012	.043	-.01	.003	-.001	.66	.002	1149
0	0	.001	.031	-.01	.003	-.001	1.00	.003	1149
-12.5	-.57	.091	.142	0	.001	.001	.92	.002	1151
-10.4	-.47	.077	.103	0	.002	0	.97	.002	1149
-10.4	-.47	.076	.103	0	.002	0	.96	.002	1148
-8.2	-.37	.062	.072	0	.002	0	.97	.003	1148
-6.0	-.27	.043	.052	0	.002	-.001	.97	.003	1149
-4.3	-.19	.029	.040	0	.002	-.001	.97	.003	1149
-2.2	-.09	.013	.032	-.01	.002	-.001	.96	.003	1149
-1.1	-.04	.008	.031	-.01	.002	-.001	.98	.002	1149
0	0	.002	.032	0	.002	-.001	.98	.002	1149
1.1	.05	-.003	.033	-.01	.003	-.001	.99	.002	1149
2.2	.09	-.007	.038	-.01	.003	-.001	1.00	.002	1149
4.3	.19	-.013	.051	0	.003	-.001	.98	.002	1149
6.9	.30	-.022	.074	-.01	.004	-.001	.98	.002	1149
9.1	.39	-.030	.102	0	.004	-.001	.99	.002	1149
11.3	.47	-.038	.138	0	.004	-.001	.99	.002	1149
13.5	.57	-.041	.179	0	.004	0	1.01	.002	1149

(c) Trimmer off

α, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
M_∞ = 1.60; R/ft = 2.0x10⁶									
-13.0	-.67	.184	.156	0	0	.001	.81	.005	991
-10.9	-.57	.156	.116	0	0	0	.84	.005	988
-8.7	-.47	.128	.083	0	.001	0	.86	.005	993
-6.5	-.36	.092	.059	0	.001	-.001	.91	.005	995
-4.4	-.24	.052	.043	0	.002	-.001	.90	.005	991
-2.3	-.13	.014	.036	0	.002	-.001	.90	.005	991
-1.2	-.08	-.002	.038	0	.002	-.001	.90	.005	991
-.1	-.02	-.015	.040	0	.003	-.001	.90	.004	992
1.0	.03	-.027	.045	0	.003	-.001	.93	.004	989
2.1	.08	-.039	.051	-.01	.003	-.001	.91	.004	991
4.3	.19	-.063	.070	0	.002	-.001	.93	.004	991
6.4	.28	-.070	.087	0	.001	0	.92	.004	990
8.6	.37	-.072	.109	0	.002	0	.91	.005	992
10.7	.46	-.075	.138	0	.001	0	.90	.004	993
12.9	.55	-.079	.171	0	.002	0	.90	.004	991
-.1	-.02	-.016	.040	-.01	.003	-.001	.90	.005	991

TABLE II.- PITCH CHARACTERISTICS; $\beta = 0.2^{\circ}$, $\delta_R \cong 0^{\circ}$ - Concluded

α, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞} lb/ft²
(d) Trimmer off, antibuzz screen extended									
M_∞ = 1.60; R/ft = 2.0×10⁶									
-0.1	-0.03	-0.003	0.052	-0.01	0.003	-0.001	0.70	0	1020
-.1	-.03	-.003	.051	-.01	.003	-.001	.67	0	1024
-.1	-.03	0	.045	-.01	.003	-.001	.48	.004	1024
-.1	-.04	.001	.046	0	.003	-.001	.38	.003	1025
-6.6	-.36	.104	.070	0	.002	-.001	.39	.002	1026
-4.4	-.25	.069	.052	0	.002	-.001	.39	.002	1026
-2.3	-.14	.032	.044	0	.002	-.001	.38	.002	1026
-1.2	-.09	.015	.044	0	.003	-.001	.38	.002	1026
-.1	-.04	0	.047	0	.003	-.001	.37	.001	1026
1.0	.02	-.012	.051	0	.003	-.001	.38	.002	1026
2.1	.07	-.025	.058	0	.003	-.001	.38	.001	1027
4.2	.17	-.052	.077	0	.002	-.001	.38	.001	1027
6.4	.27	-.064	.097	0	.002	0	.40	.001	1027
10.7	.44	-.071	.149	0	.002	0	.39	.001	1027
M_∞ = 1.80; R/ft = 2.0×10⁶									
-.1	-.02	0	.044	0	.001	-.001	.59	.002	1058
-.1	-.03	.003	.043	0	.001	-.001	.49	.003	1058
-.1	-.03	.007	.043	0	.001	-.001	.39	.003	1058
-10.7	-.48	.125	.118	0	.002	0	.39	.003	1057
-6.5	-.29	.078	.064	0	.002	0	.40	.003	1057
-4.3	-.21	.061	.048	0	.002	-.001	.40	.003	1058
-2.2	-.12	.038	.040	0	.001	-.001	.41	.003	1057
-1.2	-.08	.023	.040	0	.001	-.001	.39	.003	1058
-.1	-.03	.009	.042	0	0	-.001	.39	.003	1057
1.0	.01	-.004	.047	0	0	-.001	.39	.002	1058
2.0	.05	-.017	.052	0	0	-.001	.39	.002	1058
4.2	.14	-.045	.071	0	0	-.001	.38	.002	1057
6.3	.23	-.064	.093	0	0	-.001	.37	.002	1057
10.7	.40	-.072	.143	0	.001	0	.37	.002	1058
M_∞ = 2.00; R/ft = 2.0×10⁶									
0	0	-.013	.045	0	.003	-.001	.56	.003	1149
0	0	-.013	.045	0	.003	-.001	.56	.003	1148
0	0	-.011	.047	0	.003	-.001	.49	.003	1148
0	-.01	-.009	.049	0	.003	-.001	.40	.003	1149
-10.7	-.44	.094	.114	0	.001	-.001	.42	.003	1150
-6.5	-.26	.052	.065	0	.002	0	.42	.004	1150
-4.3	-.17	.029	.052	0	.002	-.001	.42	.004	1149
-2.2	-.09	.011	.046	0	.002	-.001	.42	.004	1149
-1.1	-.05	.002	.045	0	.002	-.001	.41	.004	1149
-.1	-.01	-.009	.049	0	.003	-.001	.40	.004	1149
1.0	.03	-.019	.053	0	.003	-.001	.41	.004	1149
2.1	.07	-.028	.058	0	.003	-.001	.40	.003	1149
4.2	.15	-.048	.073	0	.003	-.001	.38	.003	1149
6.3	.23	-.064	.093	0	.003	-.001	.38	.003	1149
10.6	.38	-.072	.139	0	.003	-.001	.39	.003	1149
(e) Ventral fins on									
M_∞ = 2.00; R/ft = 2.0×10⁶									
-10.8	-.49	.088	.107	-.01	.003	0	1.01	.003	1159
-6.5	-.29	.054	.053	-.01	.003	-.001	1.02	.003	1159
-4.3	-.19	.034	.038	-.01	.003	-.001	1.01	.003	1159
-2.2	-.09	.016	.030	-.01	.003	-.001	1.00	.002	1159
-1.1	-.04	.009	.030	-.01	.004	-.001	1.01	.002	1159
0	.01	.002	.031	-.01	.004	-.001	1.01	.002	1159
1.1	.05	-.003	.034	-.01	.004	-.001	1.00	.002	1159
2.2	.10	-.010	.039	-.01	.004	-.001	.99	.002	1159
4.3	.20	-.021	.054	-.01	.005	-.001	.98	.002	1159
6.5	.29	-.031	.076	-.01	.005	-.001	.97	.002	1159
10.8	.46	-.054	.137	-.01	.005	-.001	.96	.002	1159
0	.01	-.002	.031	-.01	.004	-.001	1.00	.002	1159

TABLE III.- SIDESLIP CHARACTERISTICS; R/FT = 2.0×10^6

(a) Basic model; $\delta_R \cong 0^\circ$

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞} lb/ft²
$M_\infty = 1.60;\ \alpha = 0^\circ$									
2.1	-0.02	0.015	0.032	-0.04	0.013	-0.010	0.90	0.004	992
1.1	-.02	.012	.033	-.02	.008	-.005	.89	.004	991
0	-.02	.012	.033	0	.002	0	.90	.004	989
-1.0	-.02	.014	.032	.02	-.003	.004	.90	.004	991
-2.0	-.02	.017	.031	.04	-.008	.009	.90	.004	991
-4.0	-.03	.033	.028	.07	-.018	.018	.91	.004	991
-6.1	-.03	.056	.024	.12	-.031	.026	.90	.004	991
-8.1	-.04	.088	.019	.16	-.043	.034	.90	.005	991
$M_\infty = 1.60;\ \alpha = 5.5^\circ$									
2.2	.26	-.015	.068	-.04	.013	-.011	.91	.004	991
1.2	.26	-.018	.067	-.02	.008	-.006	.91	.004	991
.2	.26	-.019	.067	0	.003	-.001	.91	.004	991
-.8	.26	-.018	.067	.02	-.001	.004	.91	.004	991
-1.8	.26	-.014	.066	.03	-.005	.009	.91	.004	991
-3.8	.26	0	.062	.07	-.014	.018	.91	.004	991
-7.8	.26	.054	.051	.16	-.037	.032	.90	.005	991
-5.8	.26	.021	.057	.11	-.024	.025	.91	.005	991
$M_\infty = 1.60;\ \alpha = 11^\circ$									
.2	.53	-.054	.154	-.01	.002	-.001	.91	.005	991
2.1	.53	-.050	.153	-.03	-.001	-.011	.90	.005	991
1.1	.53	-.051	.153	-.02	-.003	-.007	.91	.005	991
-.7	.53	-.054	.154	.01	.007	.004	.91	.005	991
-1.6	.53	-.052	.153	.02	.011	.009	.91	.005	991
-3.6	.53	-.039	.150	.06	-.002	.016	.90	.005	991
-5.6	.53	-.015	.143	.11	-.011	.022	.90	.005	991
-7.6	.53	.021	.134	.16	-.024	.026	.89	.005	991
$M_\infty = 1.60;\ \alpha = -5.5^\circ$									
2.2	-.30	.063	.052	-.04	.010	-.010	.89	.005	991
1.2	-.30	.061	.051	-.02	.006	-.006	.89	.006	991
.2	-.30	.060	.052	0	.002	-.001	.90	.005	991
-.8	-.30	.061	.052	.01	-.001	.003	.89	.005	991
-1.8	-.31	.065	.052	.03	-.005	.007	.89	.005	991
-3.8	-.31	.076	.049	.06	-.015	.016	.88	.005	991
-5.9	-.32	.096	.047	.10	-.027	.025	.87	.005	991
$M_\infty = 1.60;\ \alpha = -11^\circ$									
2.2	-.58	.116	.125	-.03	.011	-.007	.85	.005	986
1.2	-.58	.113	.125	-.02	.007	-.003	.87	.005	991
.2	-.57	.113	.124	0	.002	0	.87	.005	993
-.8	-.57	.115	.124	.01	-.003	.004	.86	.005	993
-1.8	-.58	.118	.124	.02	-.007	.007	.87	.005	993
-3.9	-.58	.128	.124	.06	-.020	.015	.84	.005	991
-5.9	-.60	.136	.125	.10	-.036	.023	.80	.006	990
-7.9	-.61	.150	.123	.13	-.040	.028	.77	.006	990
-3.9	-.58	.127	.123	.05	-.019	.015	.84	.006	991
$M_\infty = 1.80;\ \alpha = 0^\circ$									
2.2	0	.016	.028	-.04	.009	-.011	.97	.003	1057
1.2	0	.012	.029	-.02	.005	-.006	.97	.003	1057
.2	0	.011	.029	-.01	.001	-.002	.98	.003	1057
-.8	0	.012	.029	.01	-.001	.003	.98	.003	1057
-1.8	0	.016	.028	.03	-.005	.007	.97	.003	1057
-3.8	-.01	.031	.025	.07	-.013	.016	.98	.003	1057
-5.8	-.02	.052	.021	.11	-.023	.024	.96	.003	1057
-7.9	-.02	.078	.016	.16	-.038	.031	.94	.003	1057
$M_\infty = 1.80;\ \alpha = 5.5^\circ$									
2.2	.25	-.012	.062	-.04	.008	-.011	.98	.003	1058
1.2	.25	-.016	.063	-.02	.005	-.006	.97	.003	1058
.2	.25	-.018	.063	-.01	.001	-.001	.97	.003	1058
-.8	.25	-.016	.062	.01	-.002	.003	.98	.003	1057
-1.8	.25	-.013	.061	.03	-.006	.008	.97	.003	1057
-3.8	.24	.004	.056	.07	-.012	.017	.97	.003	1058
-5.8	.24	.028	.050	.11	-.022	.024	.95	.003	1057
-7.8	.24	.062	.044	.16	-.034	.031	.94	.003	1057
$M_\infty = 1.80;\ \alpha = 11^\circ$									
2.1	.50	-.038	.142	-.04	0	-.010	.94	.003	1057
1.1	.50	-.040	.142	-.02	-.003	-.006	.94	.003	1057
.2	.50	-.042	.142	-.01	0	-.002	.94	.003	1057
-.7	.50	-.042	.142	.01	.004	.003	.95	.003	1057
-1.7	.50	-.040	.141	.02	.007	.008	.94	.003	1057
-3.6	.50	-.027	.138	.07	-.003	.014	.94	.003	1057
-5.6	.50	-.004	.132	.11	-.011	.020	.94	.003	1057
-7.5	.50	.032	.124	.17	-.021	.024	.93	.003	1057
$M_\infty = 1.80;\ \alpha = -5.5^\circ$									
2.2	-0.25	0.053	0.046	-0.04	0.009	-0.009	0.94	0.003	1057
1.2	-.25	.050	.045	-.02	.005	-.005	.94	.003	1057
.2	-.25	.049	.045	-.01	.002	-.001	.94	.003	1057
-.8	-.25	.051	.045	.01	-.001	.003	.95	.003	1057
-1.8	-.25	.055	.045	.03	-.005	.007	.95	.003	1057
-3.8	-.26	.068	.043	.07	-.013	.014	.93	.003	1057
-5.9	-.27	.090	.040	.10	-.025	.022	.92	.003	1057
-7.9	-.28	.115	.037	.15	-.038	.029	.90	.004	1057
$M_\infty = 1.80;\ \alpha = -11^\circ$									
2.3	-.51	.097	.113	-.03	.014	-.007	.90	.004	1058
1.2	-.51	.095	.112	-.02	.009	-.003	.91	.004	1058
.2	-.51	.095	.112	0	.003	0	.92	.004	1057
-.8	-.51	.097	.111	.02	-.004	.003	.93	.004	1057
-1.8	-.51	.100	.111	.03	-.010	.007	.91	.004	1057
-3.9	-.52	.110	.111	.06	-.021	.013	.89	.004	1057
-5.9	-.53	.117	.112	.11	-.036	.020	.83	.004	1057
-7.9	-.55	.135	.111	.14	-.039	.024	.79	.005	1057
$M_\infty = 2.00;\ \alpha = 0^\circ$									
2.0	.02	.001	.032	-.04	.007	-.008	1.00	.002	1149
2.0	0	.004	.031	-.04	.007	-.008	1.00	.002	1149
1.0	0	0	.032	-.02	.004	-.004	1.00	.002	1149
0	0	-.002	.032	0	.002	0	1.00	.002	1150
-1.0	0	-.001	.032	.02	-.001	.004	1.00	.002	1149
-2.0	0	.003	.031	.03	-.004	.007	.99	.002	1149
-4.1	-.01	.021	.027	.08	-.010	.015	.99	.002	1149
-6.2	-.01	.043	.022	.12	-.020	.022	.95	.002	1149
-8.3	-.02	.070	.017	.17	-.035	.028	.93	.002	1149
$M_\infty = 2.00;\ \alpha = 5.5^\circ$									
2.0	.24	-.018	.062	-.04	.008	-.009	.97	.002	1149
1.0	.24	-.022	.062	-.02	.006	-.005	.97	.003	1149
0	.24	-.023	.063	0	.003	0	.97	.002	1149
-1.0	.24	-.021	.062	.02	.001	.004	.97	.002	1149
-1.9	.24	-.016	.060	.03	-.002	.008	.96	.002	1149
-3.9	.23	.001	.055	.07	-.005	.016	.96	.002	1149
-5.9	.23	.029	.048	.12	-.017	.023	.97	.002	1149
-7.9	.22	.062	.042	.18	-.028	.028	.94	.002	1149
$M_\infty = 2.00;\ \alpha = 11^\circ$									
1.9	.46	-.035	.131	-.03	.002	-.008	.96	.003	1149
1.0	.46	-.037	.131	-.02	.002	-.004	.97	.003	1149
.1	.46	-.038	.131	0	.004	0	.96	.003	1149
-.9	.46	-.036	.131	.02	.007	.005	.96	.003	1149
-1.8	.46	-.034	.130	.03	.007	.009	.95	.003	1149
-3.8	.46	-.016	.126	.08	0	.016	.96	.003	1149
-5.7	.46	.011	.118	.13	-.006	.020	.94	.003	1149
-7.6	.46	.044	.111	.19	-.013	.022	.94	.003	1149
.1	.46	-.038	.131	0	.005	0	.96	.003	1149
$M_\infty = 2.00;\ \alpha = -5.5^\circ$									
2.0	-.24	.041	.043	-.04	.009	-.006	.99	.003	1150
2.0	-.24	.041	.043	-.04	.009	-.006	.98	.002	1148
1.0	-.24	.038	.043	-.02	.005	-.003	1.00	.002	1148
0	-.24	.038	.043	0	.001	0	1.00	.002	1148
-1.0	-.24	.040	.043	.02	-.003	.003	1.01	.003	1149
-2.0	-.24	.045	.043	.04	-.007	.006	.99	.002	1149
-4.0	-.25	.059	.041	.07	-.016	.012	.95	.003	1149
-6.0	-.26	.080	.039	.12	-.026	.018	.93	.003	1149
-8.1	-.28	.102	.036	.16	-.037	.024	.91	.003	1149
-8.1	-.28	.102	.037	.16	-.038	.023	.91	.003	1149
0	-.24	.036	.043	0	.002	-.001	1.00	.003	1149
$M_\infty = 2.00;\ \alpha = -11^\circ$									
2.1	-.49	.083	.107	-.04	.015	-.006	.97	.003	1149
1.1	-.48	.082	.106	-.02	.008	-.002	1.00	.003	1149
-1.0	-.49	.084	.105	.02	-.007	.005	.99	.003	1149
-2.0	-.49	.087	.105	.04	-.014	.008	.99	.003	1149
-4.1	-.49	.094	.106	.08	-.026	.013	.91	.003	1149
-6.1	-.50	.099	.108	.12	-.038	.018	.86	.003	1149
-8.0	-.52	.112	.109	.16	-.040	.021	.81	.003	1149
0	-.49	.082	.104	0	.002	.001	.99	.003	1149
0	-.49	.082	.105	0	.002	.001	1.01	.003	1149

TABLE III.- SIDESLIP CHARACTERISTICS; R/FT = 2.0×10^6 - Continued

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	Pt_∞ lb/ft²
(b) Trimmer off; $\delta_R \cong 0^\circ$									
$M_\infty = 1.60$; $\alpha = 0^\circ$									
2.1	-0.03	-0.011	0.039	-0.04	0.012	-0.009	0.90	0.004	991
1.0	-.03	-.013	.040	-.02	.007	-.004	.91	.004	991
0	-.03	-.015	.041	0	.002	0	.90	.004	992
-1.0	-.03	-.013	.040	.02	-.003	.004	.91	.004	990
-2.0	-.03	-.008	.038	.04	-.008	.009	.90	.004	990
-4.0	-.03	.005	.034	.07	-.018	.017	.90	.004	991
-6.1	-.04	.026	.030	.12	-.030	.025	.91	.004	991
-8.1	-.05	.056	.024	.16	-.040	.032	.90	.005	991
2.1	-.03	-.011	.039	-.04	.012	-.009	.90	.005	992
.2	-.02	-.015	.040	-.01	.003	-.001	.91	.004	991
$M_\infty = 1.60$; $\alpha = 5.5^\circ$									
2.0	.24	-.068	.080	-.04	.007	-.008	.94	.004	991
1.0	.24	-.068	.078	-.02	.004	-.004	.91	.004	991
0	.23	-.068	.077	0	.001	0	.91	.004	990
-1.0	.24	-.066	.077	.02	-.002	.004	.91	.004	991
-2.0	.23	-.064	.077	.04	-.005	.008	.94	.004	992
-4.0	.23	-.060	.077	.08	-.015	.016	.92	.004	991
-6.0	.23	-.042	.071	.12	-.024	.023	.91	.005	989
$M_\infty = 1.60$; $\alpha = 11^\circ$									
1.9	.46	-.073	.136	-.05	.005	-.007	.90	.005	988
1.0	.46	-.074	.136	-.03	.006	-.003	.91	.004	988
.1	.46	-.074	.136	-.01	.006	.001	.93	.004	992
-.9	.46	-.075	.135	.01	.005	.004	.91	.005	989
-1.8	.46	-.075	.137	.04	.005	.008	.94	.004	988
-3.7	.46	-.074	.138	.08	.003	.014	.90	.005	992
-5.7	.46	-.072	.140	.13	-.005	.018	.91	.005	991
$M_\infty = 2.00$; $\alpha = 0^\circ$									
2.0	0	-.024	.039	-.04	.008	-.008	1.02	.001	1148
1.0	0	-.028	.040	-.02	.005	-.004	1.03	.002	1154
.2	0	-.031	.040	-.01	.003	-.001	1.03	.002	1144
-1.0	0	-.029	.039	.02	-.001	.003	1.03	.002	1151
-2.0	0	-.024	.038	.03	-.004	.007	1.03	.002	1154
-4.0	-.01	-.008	.033	.07	-.010	.014	1.01	.002	1152
-6.0	-.01	.013	.028	.11	-.018	.020	1.02	.002	1152
.2	.01	-.031	.040	-.01	.003	-.001	1.02	.002	1152
$M_\infty = 2.00$; $\alpha = 5.5^\circ$									
2.0	.22	-.066	.072	-.04	.008	-.008	.96	.002	1151
1.0	.22	-.066	.071	-.02	.006	-.004	.94	.002	1151
0	.22	-.065	.070	0	.004	0	.88	.002	1152
-.9	.22	-.066	.070	.02	.002	.004	.98	.002	1149
-1.9	.22	-.066	.070	.03	0	.007	.99	.002	1148
-3.9	.22	-.058	.070	.08	-.007	.014	.98	.002	1148
-5.9	.21	-.034	.062	.13	-.015	.020	.95	.002	1148
(c) Ventral fins on; $\delta_R \cong 0^\circ$									
$M_\infty = 1.80$; $\alpha = 0^\circ$									
2.1	-.02	.026	.026	-.04	.015	-.008	.97	.003	1102
1.1	-.02	.024	.026	-.02	.007	-.004	.97	.003	1102
0	-.01	.024	.026	0	0	0	.96	.003	1104
-1.0	-.01	.026	.026	.02	-.008	.004	.97	.003	1106
-2.1	-.02	.030	.025	.04	-.014	.007	.97	.003	1106
-4.1	-.02	.043	.022	.08	-.029	.014	.97	.003	1106
-6.2	-.03	.070	.017	.12	-.040	.022	.96	.003	1106
0	-.02	.024	.026	0	.002	-.001	.97	.003	1106
$M_\infty = 1.80$; $\alpha = 11^\circ$									
2.0	.48	-.061	.148	-.04	.007	-.007	.95	.003	1106
1.0	.48	-.060	.146	-.02	.003	-.003	.95	.003	1106
0	.48	-.061	.147	0	.002	0	.95	.003	1106
-.9	.48	-.060	.147	.01	.001	.003	.95	.003	1106
-1.9	.48	-.060	.147	.03	-.002	.006	.95	.003	1106
-4.0	.49	-.047	.143	.08	-.018	.010	.95	.003	1105
-6.0	.48	-.021	.135	.13	-.031	.013	.94	.003	1106
0	.48	-.060	.144	0	.002	-.001	.95	.004	1106
$M_\infty = 2.00$; $\alpha = 0^\circ$									
2.1	0	.006	.030	-.04	.015	-.007	1.01	.002	1161
1.1	0	.003	.031	-.02	.008	-.004	1.00	.002	1162
0	.01	.002	.031	0	.001	0	1.01	.002	1163
-1.0	.01	.004	.030	.02	-.005	.003	1.00	.002	1158
-2.0	0	.007	.030	.04	-.012	.006	1.01	.002	1160
-4.1	0	.020	.026	.08	-.023	.012	1.00	.002	1160
-6.1	-.01	.039	.022	.12	-.036	.018	.98	.002	1159
0	0	.002	.031	-.01	.003	-.001	1.01	.002	1160

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	Pt_∞ lb/ft²
(c) Ventral fins on (Concluded)									
$M_\infty = 2.00$; $\alpha = 5.5^\circ$									
2.1	0.24	-0.023	0.063	-0.04	0.016	-0.006	0.98	0.002	1160
1.1	.24	-.026	.064	-.02	.010	-.003	.98	.002	1160
1.1	.24	-.026	.064	-.02	.010	-.003	.98	.002	1159
0	.24	-.026	.064	0	.003	0	.98	.002	1159
-1.0	.24	-.023	.063	.02	-.004	.003	.98	.002	1159
-2.0	.23	-.020	.062	.04	-.010	.006	.98	.002	1159
-4.0	.24	-.007	.058	.08	-.022	.012	.97	.002	1159
-6.1	.23	.016	.051	.13	-.037	.017	.96	.002	1159
0	.24	-.026	.063	0	.004	-.001	.98	.002	1159
$M_\infty = 2.00$; $\alpha = 11^\circ$									
2.0	.46	-.053	.139	-.04	.011	-.006	.97	.002	1159
1.0	.46	-.054	.139	-.02	.007	-.003	.96	.002	1159
.1	.46	-.053	.138	0	.004	0	.95	.002	1159
-.9	.46	-.053	.138	.02	.003	.003	.96	.002	1159
-1.9	.46	-.050	.137	.04	-.001	.005	.96	.002	1159
-3.9	.47	-.038	.134	.09	-.016	.009	.96	.002	1159
-5.9	.47	-.015	.127	.14	-.027	.012	.95	.003	1159
.1	.46	-.054	.137	0	.005	0	.95	.003	1160
(d) Vertical tail off; $\delta_R \cong 0^\circ$									
$M_\infty = 1.60$; $\alpha = 0^\circ$									
1.8	-.02	.012	.031	-.02	-.018	-.005	.90	.004	991
.9	-.02	-.004	.033	-.01	-.010	-.003	.90	.004	989
.2	-.01	.007	.032	0	-.002	-.001	.90	.004	989
-.9	-.02	.008	.032	.01	.009	.002	.90	.004	991
-1.8	-.02	.012	.031	.02	.018	.005	.90	.005	991
-3.6	-.02	.029	.030	.04	.034	.009	.90	.004	991
-5.3	-.03	.053	.026	.08	.039	.013	.90	.005	991
.2	-.01	.007	.033	0	-.001	0	.92	.004	991
$M_\infty = 2.00$; $\alpha = 0^\circ$									
1.8	.01	-.002	.029	-.02	-.018	-.003	.99	.002	1149
.9	0	-.005	.030	-.01	-.010	-.002	.99	.002	1151
.2	.01	-.007	.030	0	-.002	0	.99	.002	1149
-.9	.01	-.006	.030	.01	.009	.002	.99	.002	1147
-1.8	0	-.002	.030	.02	.018	.003	1.01	.001	1149
-3.6	-.01	.014	.028	.05	.034	.007	1.00	.002	1147
-5.5	-.02	.038	.024	.08	.039	.010	.98	.002	1149
.2	.01	-.008	.031	0	-.001	0	1.00	.002	1149
$M_\infty = 2.00$; $\alpha = 5.5^\circ$									
1.8	.24	-.020	.060	-.02	-.014	-.006	.96	.002	1148
.9	.24	-.024	.061	-.01	-.007	-.003	.96	.002	1148
0	.24	-.026	.061	0	.001	.001	.97	.002	1148
-.9	.24	-.024	.061	.01	.009	.004	.97	.002	1148
-1.8	.23	-.020	.059	.03	.016	.007	.96	.002	1148
-3.6	.23	.001	.053	.05	.029	.013	.96	.002	1149
-5.4	.22	.034	.046	.10	.036	.017	.96	.003	1149
0	.24	-.026	.060	.01	.002	.001	.96	.003	1149
$M_\infty = 2.00$; $\alpha = 11^\circ$									
1.8	.47	-.037	.132	-.02	-.010	-.006	.97	.002	1149
.9	.47	-.041	.132	-.01	-.004	-.003	.96	.002	1149
0	.47	-.041	.132	0	.002	.001	.97	.002	1149
-.9	.46	-.040	.131	.02	.008	.004	.95	.002	1149
-1.8	.46	-.036	.130	.03	.014	.007	.96	.002	1149
-3.5	.46	-.018	.125	.06	.026	.014	.94	.002	1149
-5.4	.46	.012	.118	.11	.029	.017	.95	.002	1149
0	.46	-.041	.131	.01	.002	.001	.96	.002	1149
$M_\infty = 2.00$; $\alpha = -5.5^\circ$									
1.8	-.24	.032	.044	-.02	-.016	.001	.97	.002	1149
.9	-.24	.029	.045	-.01	-.008	.001	1.00	.002	1149
0	-.24	.029	.044	0	0	0	1.01	.003	1149
-.9	-.24	.030	.045	.01	.009	-.001	1.01	.003	1149
-1.8	-.24	.033	.045	.02	.018	-.001	.98	.002	1149
-3.6	-.25	.046	.046	.04	.031	-.002	.96	.002	1149
-5.5	-.26	.061	.047	.07	.040	-.002	.94	.002	1149
0	-.24	.028	.045	0	.001	0	1.00	.002	1149

TABLE III.- SIDESLIP CHARACTERISTICS; R/FT = 2.0×10⁶ - Concluded

(e) Rudder deflected; $\alpha = 0^\circ$

$M_\infty = 1.60$; $\delta_R = -4^\circ$

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
2.3	-0.02	0.013	0.033	-0.05	0.021	-0.011	0.90	0.004	993
1.3	-.02	.012	.034	-.03	.015	-.006	.90	.004	984
.3	-.02	.010	.033	-.01	.010	-.002	.90	.005	989
-.7	-.02	.012	.033	.01	.004	.003	.90	.004	989
-1.88	-.02	.015	.032	.03	-.001	.008	.90	.005	991
-3.8	-.02	.029	.029	.07	-.010	.016	.90	.004	992
-5.8	-.03	.050	.024	.11	-.021	.025	.90	.005	991
-7.9	-.03	.078	.020	.15	-.035	.032	.90	.005	992

$M_\infty = 1.60$; $\delta_R = -8^\circ$

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
2.2	-.02	.014	.034	-.05	.025	-.010	.90	.005	986
1.2	-.02	.012	.035	-.03	.019	-.006	.90	.004	986
.3	-.02	.011	.035	-.01	.014	-.002	.90	.004	990
-.9	-.02	.014	.034	.01	.008	.004	.90	.004	991
-1.9	-.02	.017	.033	.03	.003	.008	.90	.004	991
-3.9	-.02	.033	.030	.07	-.007	.017	.90	.004	991
-6.0	-.03	.054	.025	.11	-.018	.025	.90	.004	991
-8.0	-.03	.083	.021	.16	-.031	.032	.90	.004	991

$M_\infty = 1.60$; $\delta_R = -12^\circ$

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
2.3	-.02	.020	.034	-.05	.032	-.011	.90	.004	1000
1.2	-.02	.017	.034	-.03	.027	-.007	.90	.004	1006
.4	-.02	.016	.034	-.01	.022	-.002	.90	.004	993
-.8	-.02	.019	.033	.01	.016	.003	.90	.004	992
-1.8	-.02	.023	.032	.03	.010	.008	.90	.004	992
-3.9	-.03	.039	.029	.07	-.001	.017	.90	.004	991
-5.9	-.03	.062	.025	.11	-.012	.025	.90	.004	991
-8.0	-.04	.090	.019	.15	-.025	.032	.90	.004	991

$M_\infty = 1.80$; $\delta_R = -4^\circ$

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
2.3	-.01	.016	.027	-.05	.015	-.011	.97	.003	1054
1.3	-.01	.013	.028	-.03	.011	-.006	.98	.003	1052
.3	0	.011	.028	-.01	.007	-.001	.98	.003	1055
-.8	-.01	.013	.027	.01	.004	.003	.98	.003	1056
-1.8	-.01	.017	.027	.03	0	.007	.97	.003	1054
-3.8	-.01	.033	.025	.07	-.007	.016	.97	.003	1054
-5.8	-.02	.054	.020	.11	-.018	.024	.95	.003	1055
-7.9	-.02	.080	.015	.16	-.032	.031	.94	.003	1055

$M_\infty = 1.80$; $\delta_R = -8^\circ$

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
2.1	-0.01	0.018	0.029	-0.04	0.018	-0.010	0.98	0.003	1055
.3	-.01	.014	.029	-.01	.011	-.002	.98	.003	1056
-.9	-.01	.016	.029	.01	.006	.003	.98	.003	1057
-1.9	-.01	.020	.028	.03	.003	.008	.97	.003	1057
-3.9	-.02	.037	.024	.07	-.005	.016	.97	.003	1057
-6.0	-.02	.059	.020	.11	-.016	.024	.95	.003	1057
-8.0	-.03	.086	.016	.16	-.030	.031	.94	.003	1057

$M_\infty = 1.80$; $\delta_R = -12^\circ$

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
2.2	-.01	.018	.031	-.05	.024	-.011	.99	.003	1087
1.2	-.01	.016	.030	-.03	.020	-.006	.97	.003	1092
.4	-.01	.014	.030	-.01	.017	-.002	.98	.003	1087
-.8	-.01	.017	.030	.01	.012	.003	.98	.003	1090
-1.9	-.01	.022	.029	.03	.009	.008	.98	.003	1090
-3.9	-.02	.039	.025	.07	.001	.016	.97	.003	1090
-5.9	-.02	.061	.021	.11	-.011	.024	.96	.003	1088
-8.0	-.03	.087	.016	.16	-.024	.031	.94	.003	1088
.4	-.01	.014	.029	-.01	.018	-.003	.97	.003	1091

$M_\infty = 2.00$; $\delta_R = -4^\circ$

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
2.3	0	.001	.031	-.04	.013	-.009	1.01	.002	1148
1.3	0	-.003	.031	-.03	.010	-.005	1.00	.002	1147
.3	0	-.005	.032	-.01	.007	-.001	1.00	.002	1143
-.8	0	-.003	.031	.01	.003	.003	1.00	.002	1149
-1.7	0	.001	.031	.03	.001	.006	1.01	.002	1151
-3.7	-.01	.016	.026	.07	-.005	.013	.99	.002	1150
-5.7	-.01	.036	.022	.10	-.012	.019	.96	.002	1150
-7.8	-.02	.063	.016	.16	-.026	.026	.94	.002	1149

$M_\infty = 2.00$; $\delta_R = -8^\circ$

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
.3	.01	-.003	.033	-.01	.011	-.002	1.01	.002	1149
-.9	.01	-.002	.033	.01	.007	.003	1.01	.002	1149
-1.9	.01	.003	.031	.03	.004	.006	1.01	.002	1149
-3.9	0	.019	.027	.07	-.002	.013	.99	.002	1149
-5.9	-.01	.041	.023	.11	-.011	.020	.97	.002	1149
-7.9	-.02	.067	.017	.16	-.024	.026	.98	.002	1149

$M_\infty = 2.00$; $\delta_R = -12^\circ$

β, deg	C_L	C_m	C_D	C_Y	C_n	C_l	m/m_∞	C_{X_b}	p_{t_∞}, lb/ft²
2.2	-.01	.003	.034	-.05	.022	-.010	1.01	.001	1155
1.2	-.01	0	.033	-.03	.019	-.006	1.01	.001	1157
.3	0	-.002	.033	-.01	.016	-.002	1.01	.002	1143
-.9	0	.001	.033	.01	.012	.002	1.01	.001	1141
-1.9	-.01	.005	.031	.03	.009	.006	1.02	.002	1147
-3.9	-.01	.021	.027	.07	.002	.013	1.00	.002	1149
-5.9	-.02	.043	.023	.11	-.007	.020	1.01	.002	1151
-7.9	-.03	.070	.017	.16	-.020	.026	.95	.002	1152

FIGURE LEGENDS

Figure 1.- Systems of axes and positive direction of forces, moments, and angles.

Figure 2.- Model photographs. (a) Basic configuration. (b) Configuration with ventral fins.

Figure 2.- Concluded. (c) Inlet with antibuzz screen extended. (d) Inlet with boundary-layer bleed closed.

Figure 3.- Model and model component details (dimensions in inches). (a) Three views of basic configuration.

Figure 3.- Continued. (b) Trimmer and ventral details.

Figure 3.- Concluded. (c) Antibuzz screen and rudder details.

Figure 4.- Inlet configurations. (a) Basic inlet. (b) Inlet with boundary-layer bleed closed. (c) Inlet with antibuzz screen extended.

Figure 5.- Longitudinal characteristics of the basic configuration; $M_\infty = 2.0$, $R/ft = 2.0\times10^6$.

Figure 6.- Variation with Mach number of pitching moment at zero lift, and aerodynamic center for the configurations tested; $R/ft=2.0\times10^6$.

Figure 7.- Variation with Reynolds number of pitching moment at zero lift, and aerodynamic center; $M_\infty=2.0$.

Figure 8.- Effect of mass-flow-ratio variation on pitching moment; $R/ft=2.0\times10^6$, $C_L\approx0$.

Figure 9.- Lateral characteristics of the basic configuration; $M_\infty=2.0$, $R/ft=2.0\times10^6$, $\alpha=0^\circ$.

Figure 10.- Variation with Mach number of rolling-moment and yawing-moment derivatives for the configurations tested; $R/ft=2.0\times10^6$. (a) $\alpha=0^\circ$.

Figure 10.- Continued. (b) $\alpha=5.5^\circ$.

Figure 10.- Continued. (c) $\alpha=11^\circ$.

Figure 10.- Concluded. (d) $\alpha=-5.5^\circ$.

Figure 11.- Variation with Mach number of rudder effectiveness; $R/ft=2.0\times10^6$, $\alpha=0^\circ$, $\beta=0^\circ$.

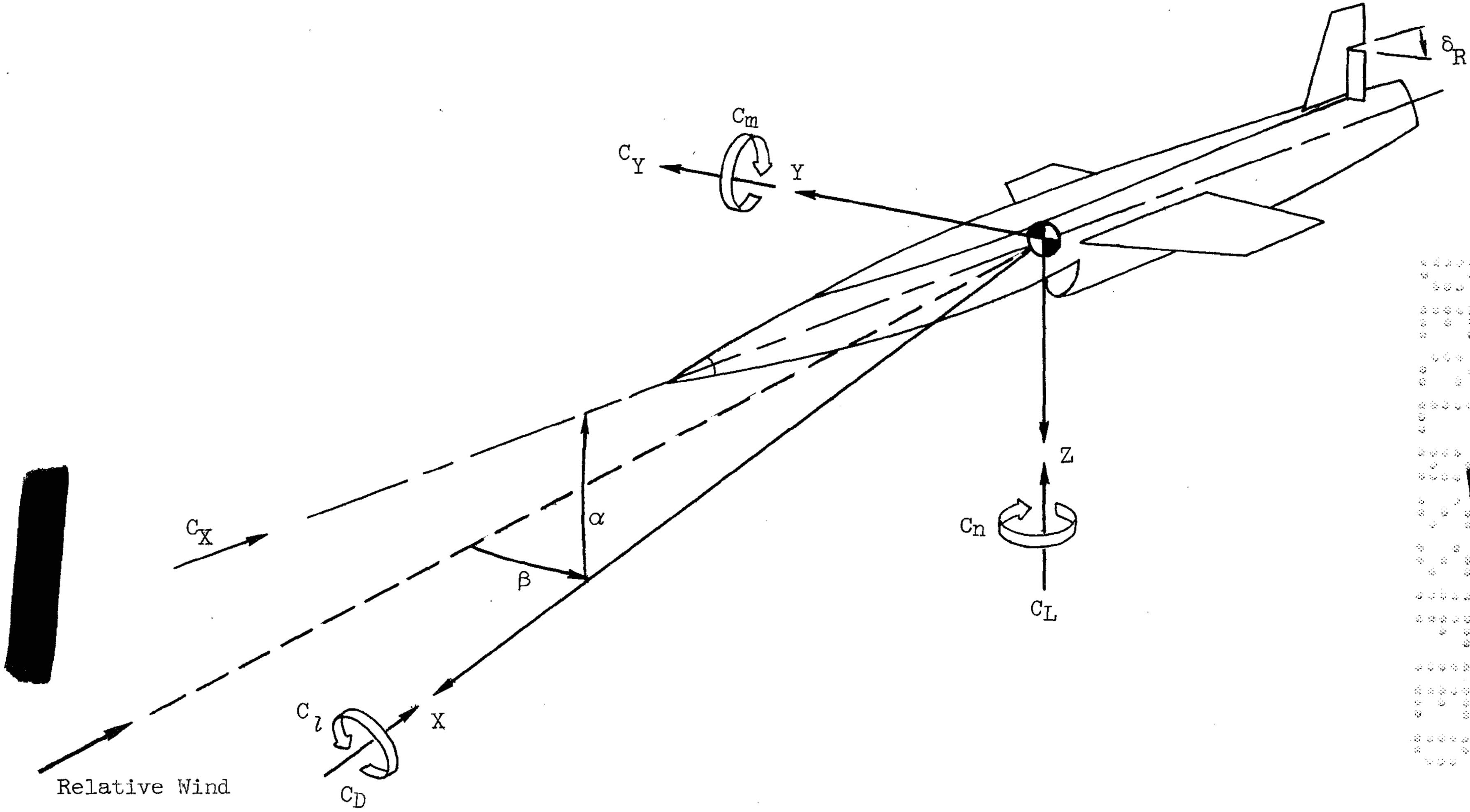

Figure 1.- Systems of axes and positive direction of forces, moments, and angles.

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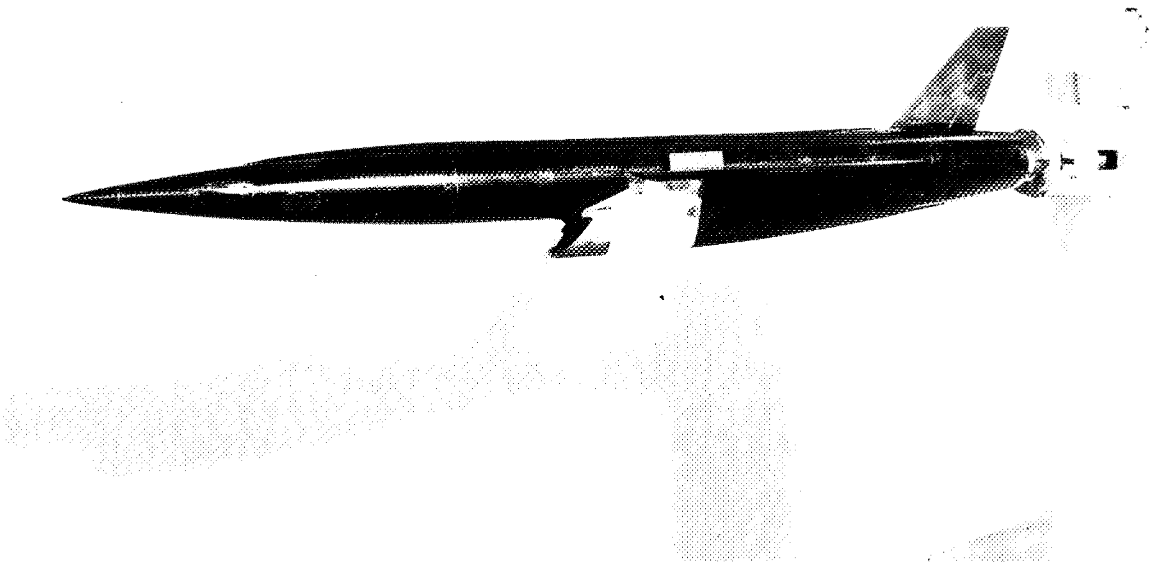
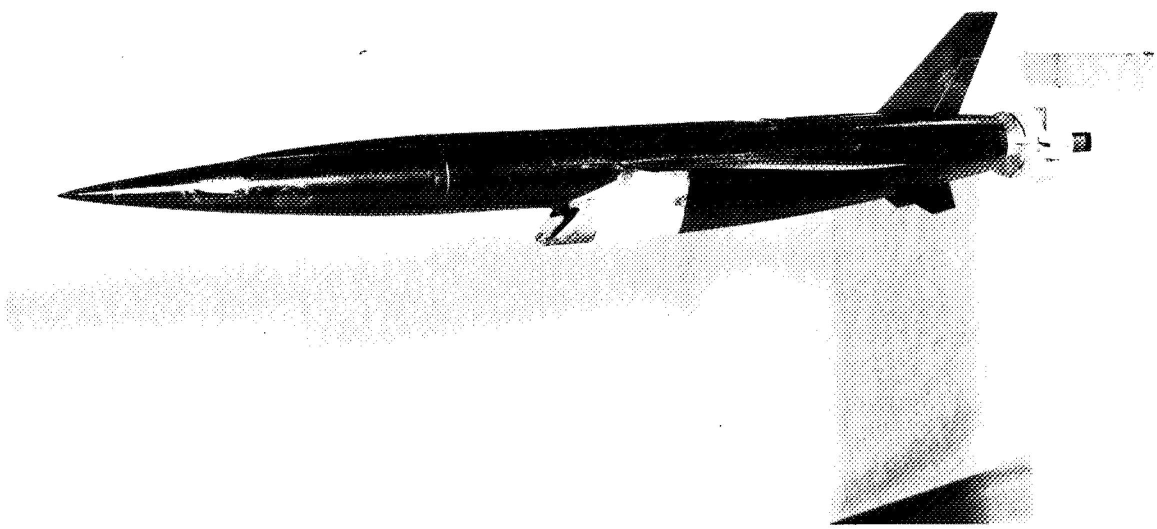


(a) Basic configuration. A-21879

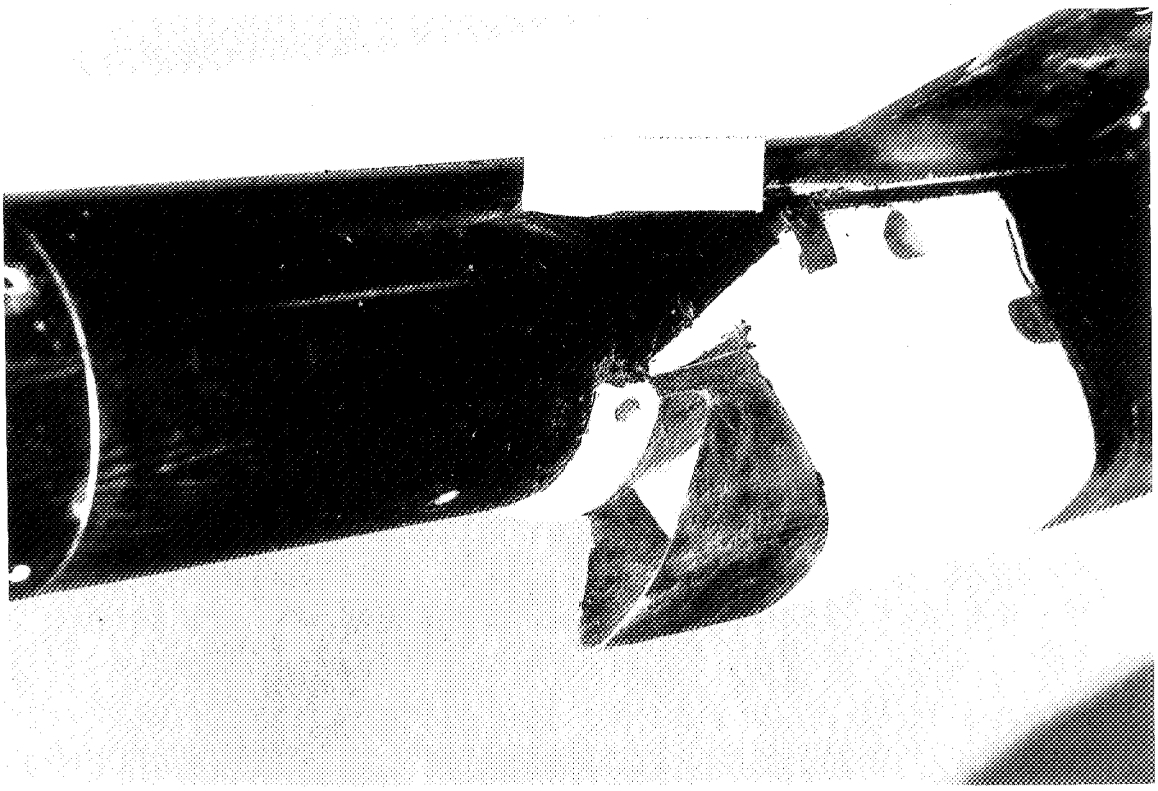


(b) Configuration with ventral fins. A-21874

Figure 2.- Model photographs.

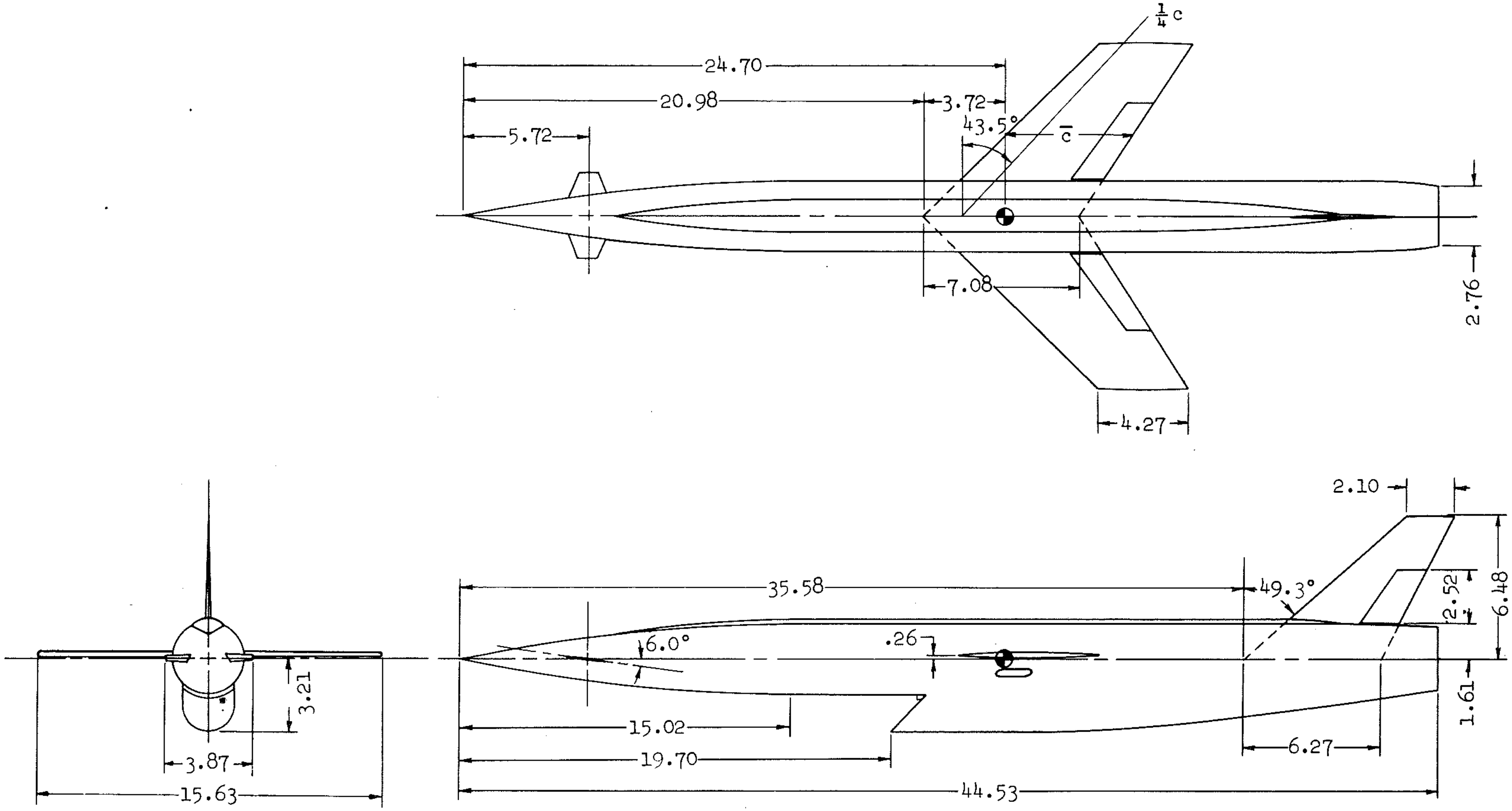
[redacted]

(c) Inlet with antibuzz screen extended. A-21885



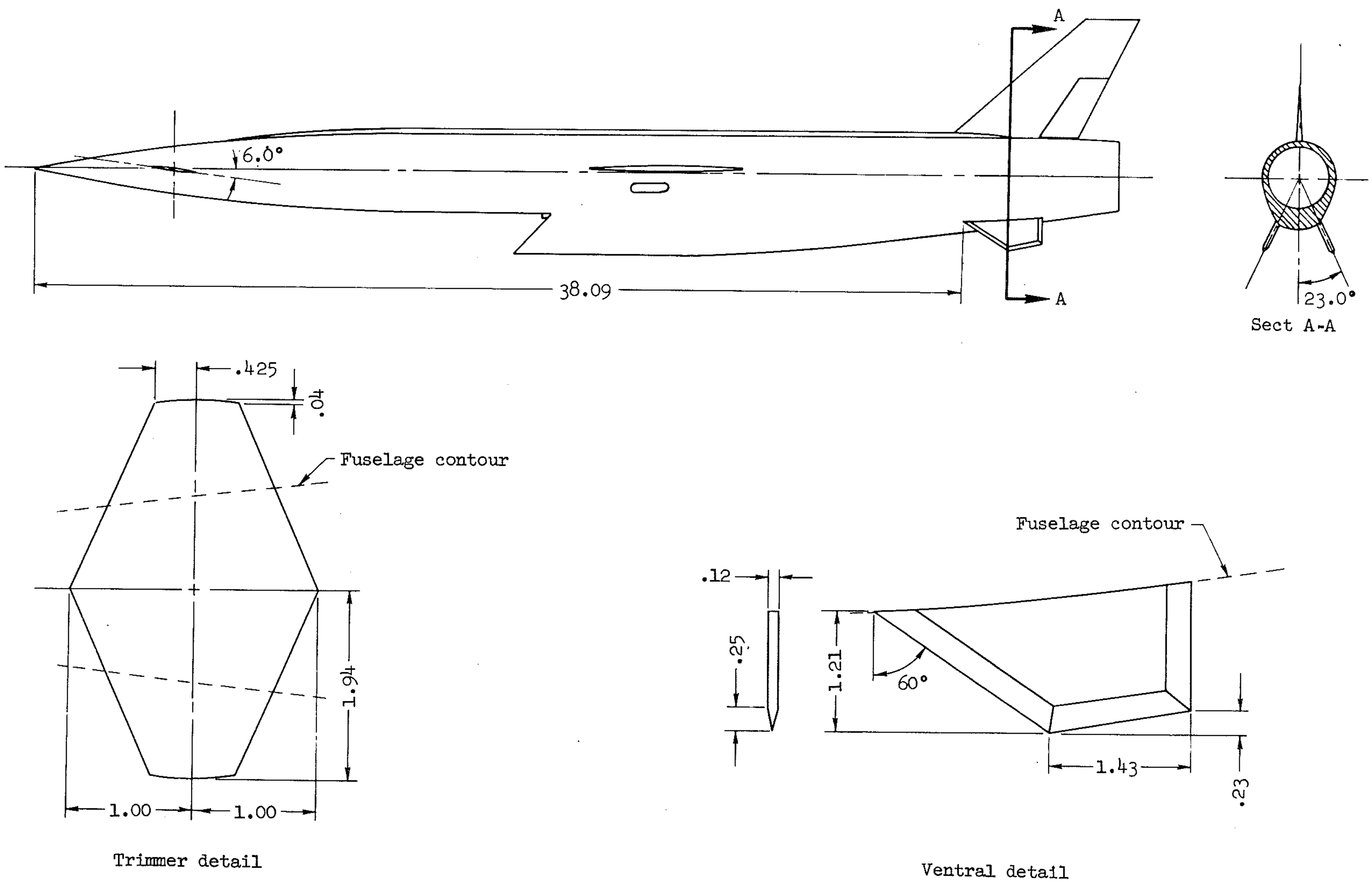
(d) Inlet with boundary-layer bleed closed. A-21881

Figure 2.- Concluded.



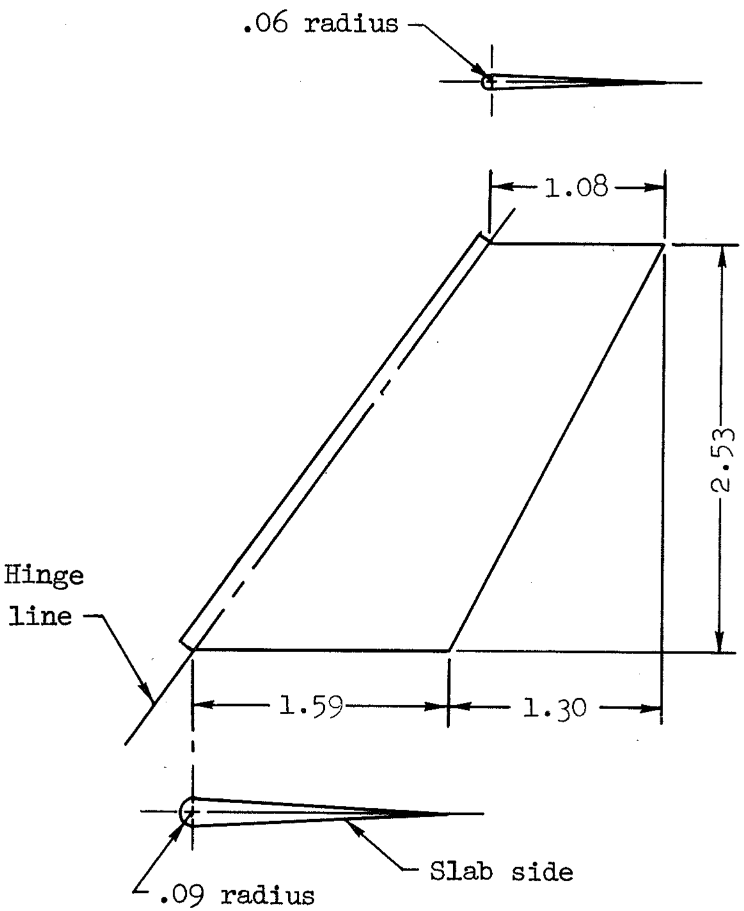
(a) Three views of basic configuration.

Figure 3.- Model and model component details (dimensions in inches).

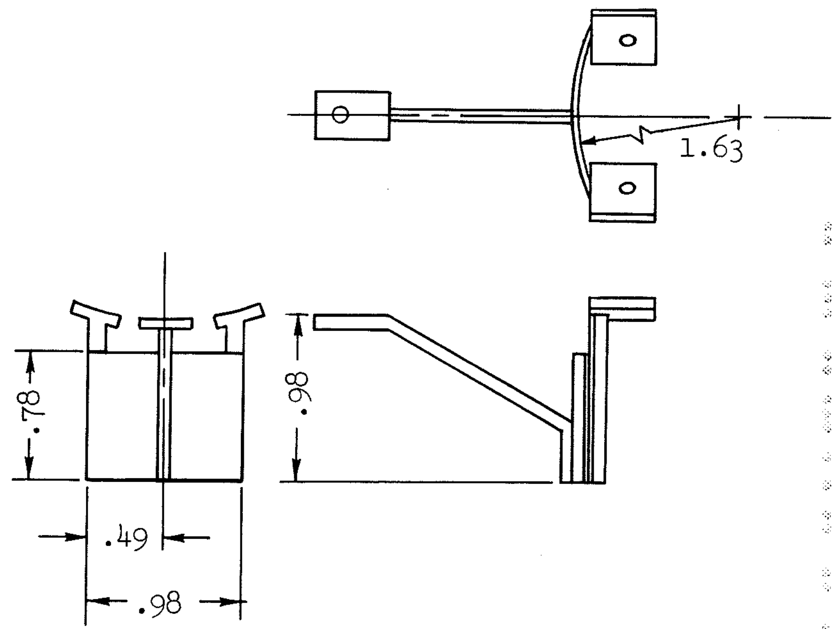


(b) Trimmer and ventral details.

Figure 3.- Continued.



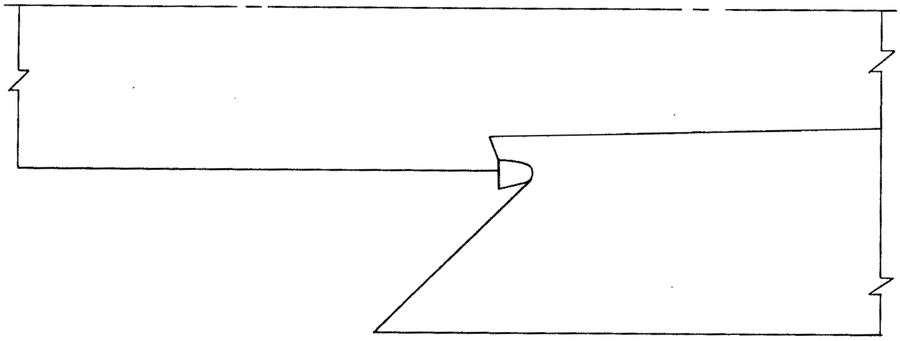
Rudder detail



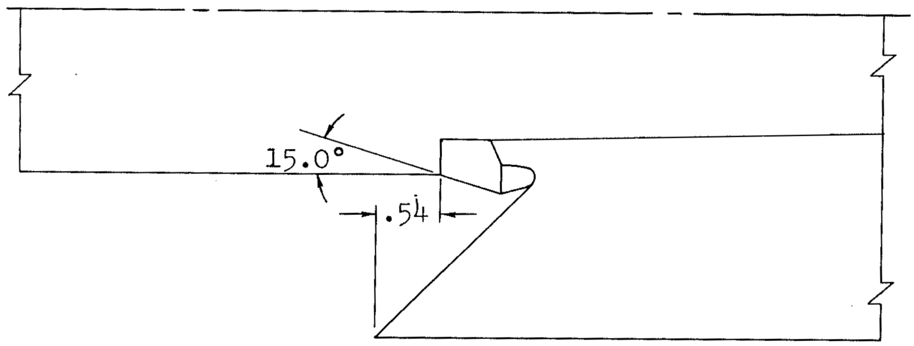
Antibuzz screen detail

(c) Antibuzz screen and rudder details.

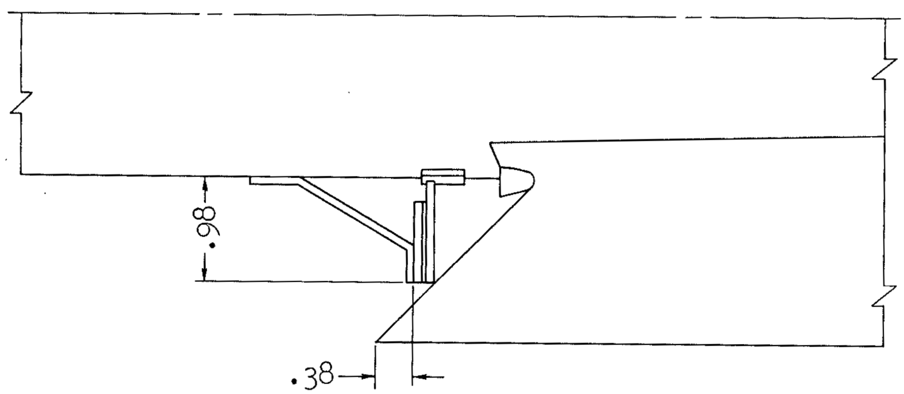
Figure 3.- Concluded.



(a) Basic inlet.



(b) Inlet with boundary-layer bleed closed.



(c) Inlet with antibuzz screen extended.

Figure 4.- Inlet configurations.

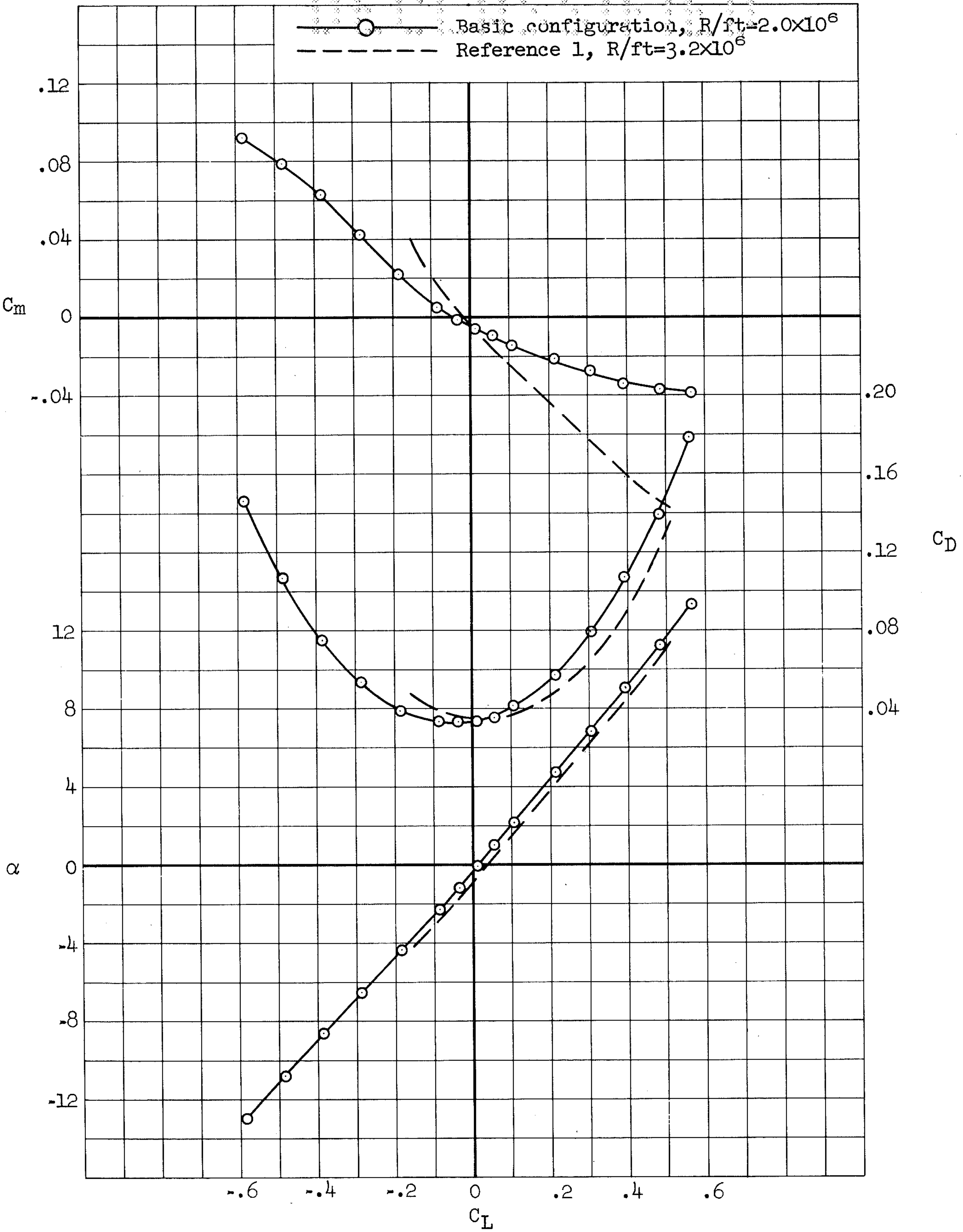


Figure 5.- Longitudinal characteristics of the basic configuration; M_∞=2.0, R/ft=2.0×10^6.

[redacted]

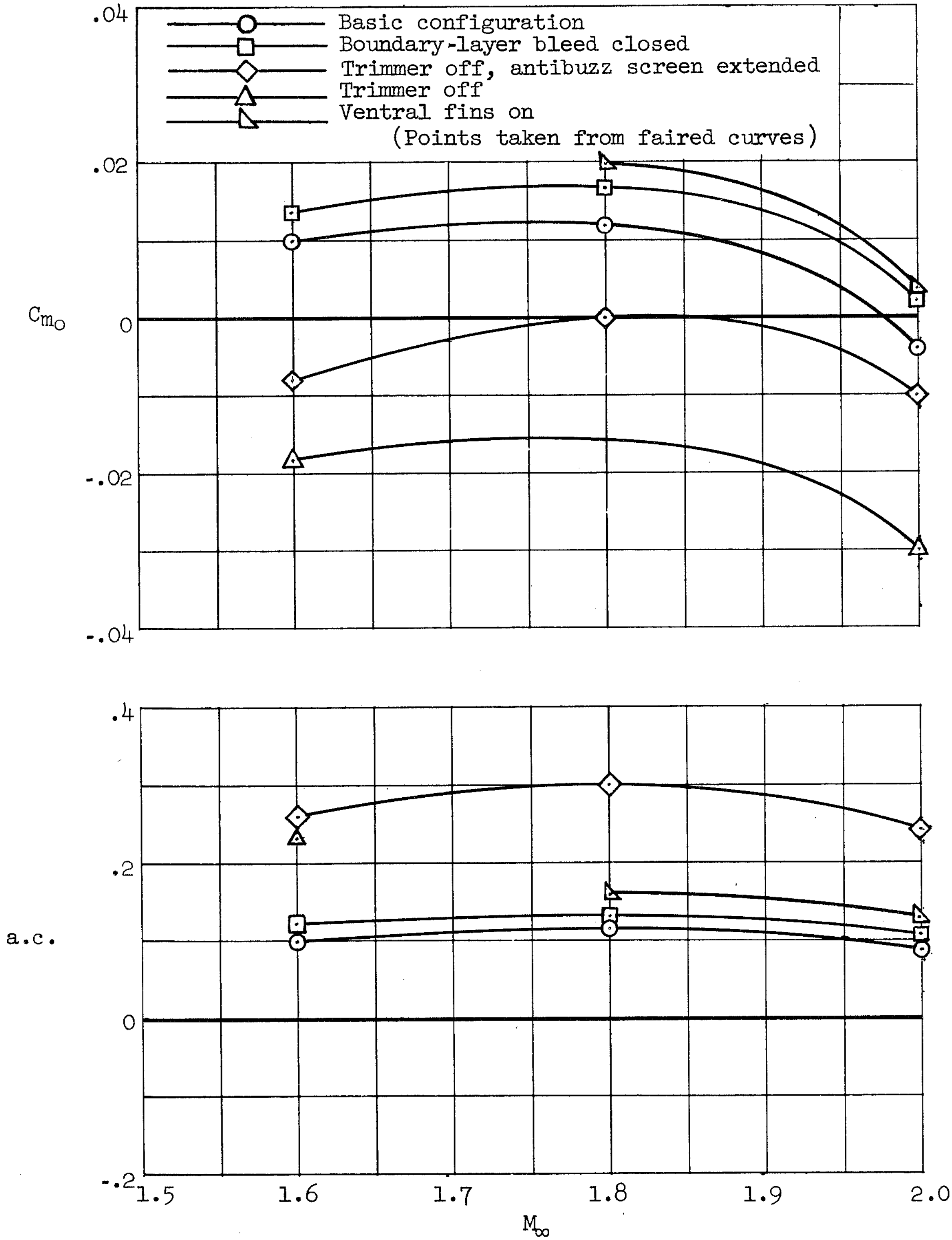


Figure 6.- Variation with Mach number of pitching moment at zero lift, and aerodynamic center for the configurations tested; $R/ft = 2.0 \times 10^6$.

[redacted]

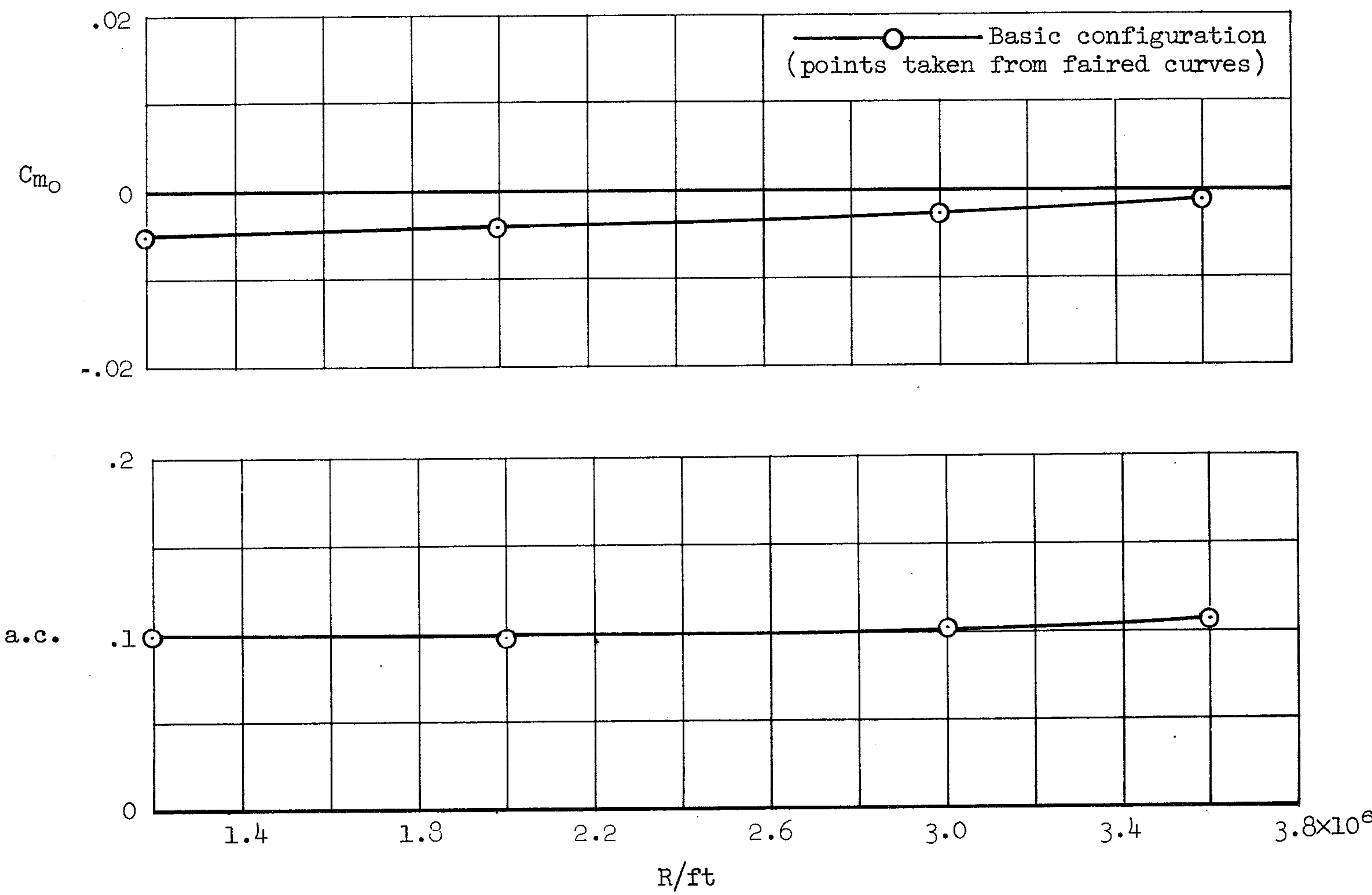


Figure 7.- Variation with Reynolds number of pitching moment at zero lift, and aerodynamic center; M_∞=2.0.

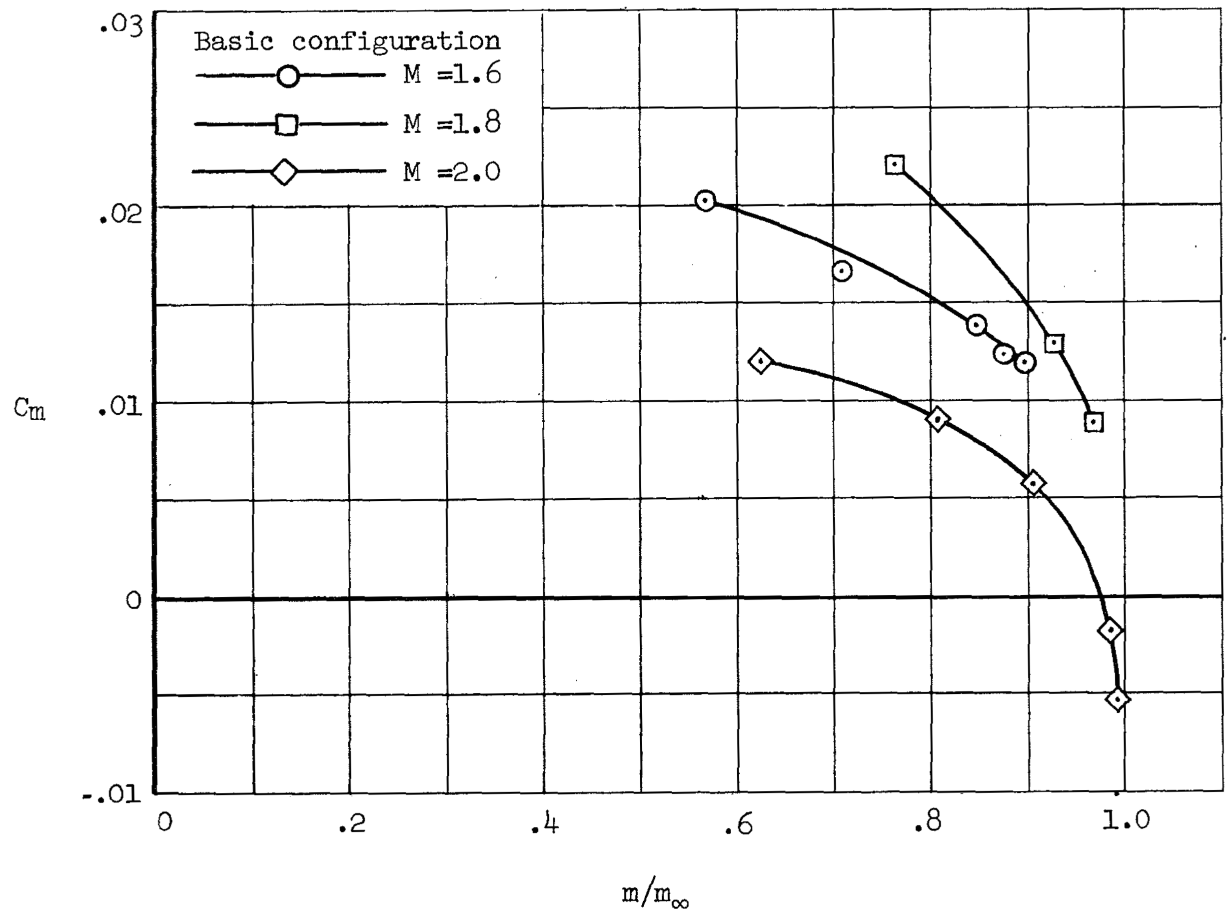


Figure 8.- Effect of mass-flow-ratio variation on pitching moment; $R/ft = 2.0 \times 10^6$, $C_L \approx 0$.

[redacted]

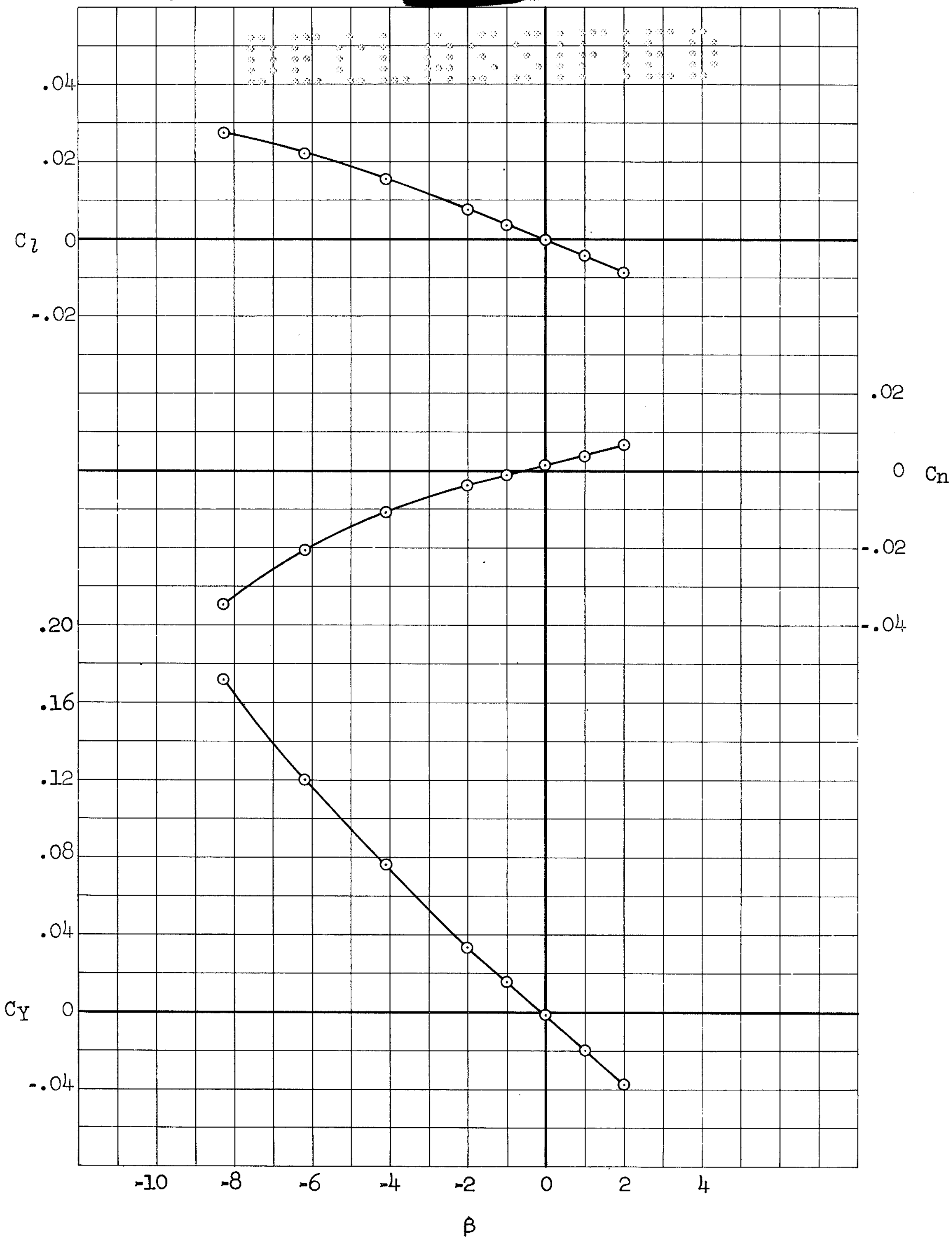
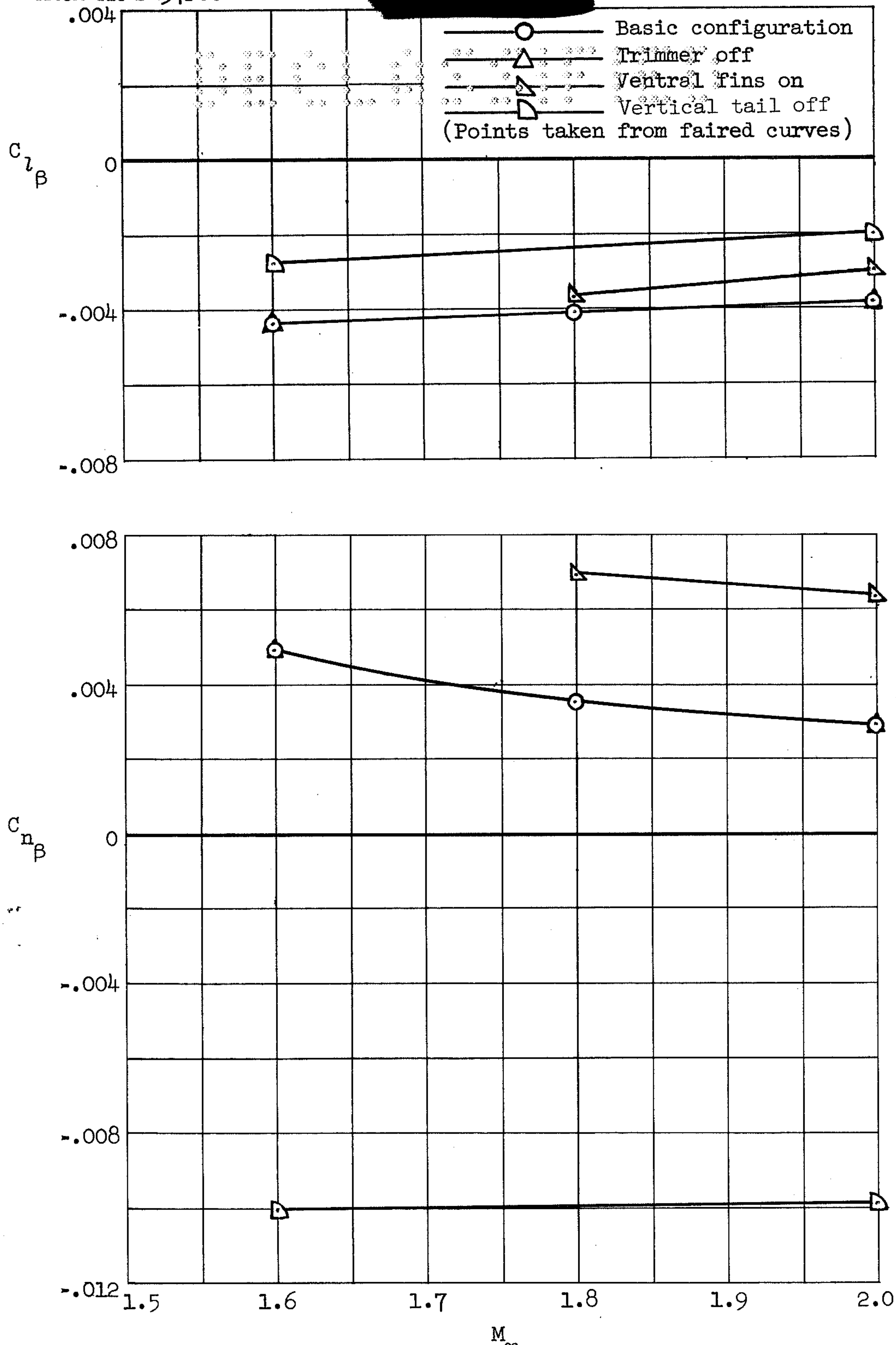


Figure 9.- Lateral characteristics of the basic configuration; $M_\infty=2.0$, $R/ft=2.0\times10^6$, $\alpha=0^\circ$.

[redacted]

[redacted]

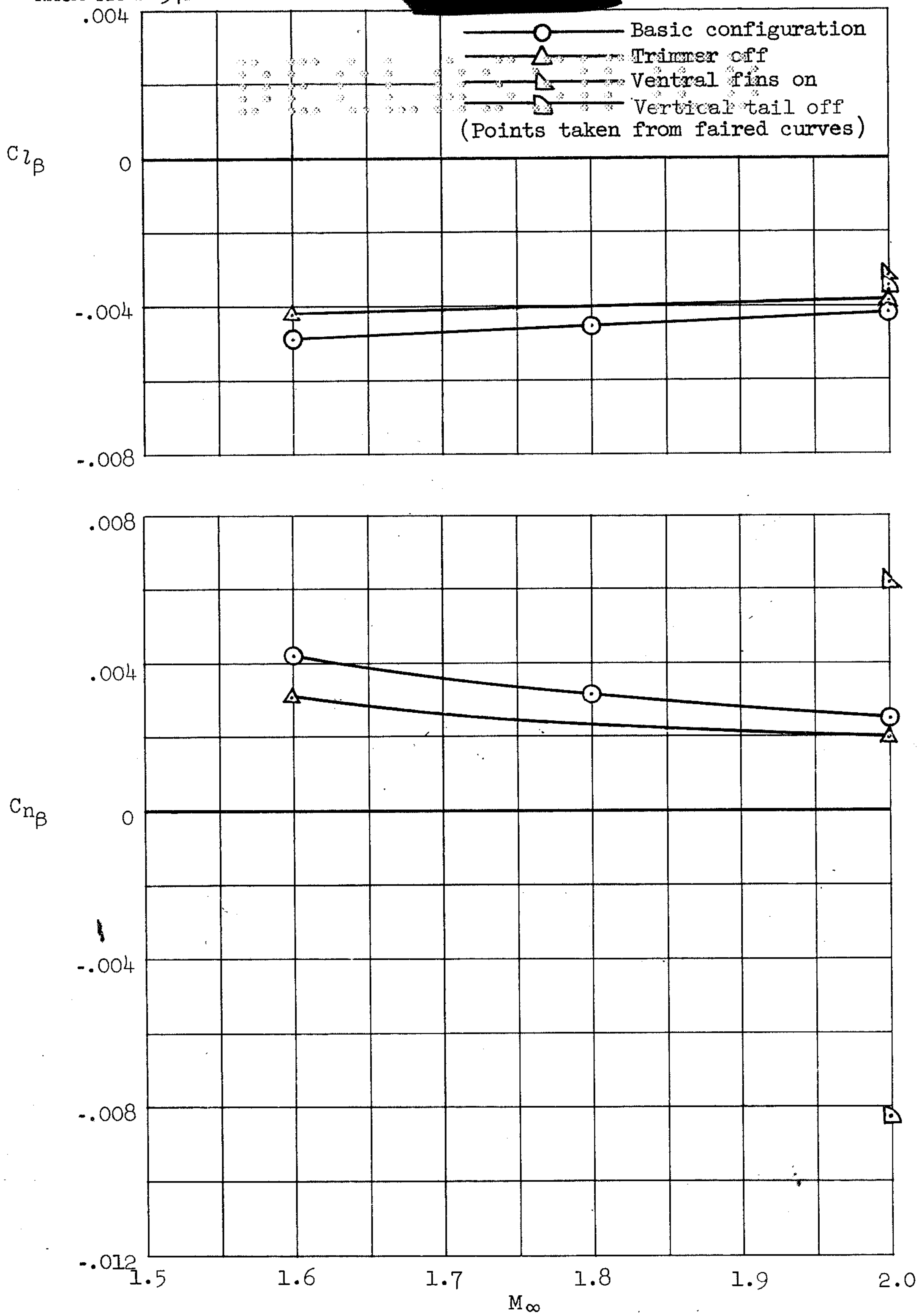


(a) $\alpha=0^\circ$

Figure 10.- Variation with Mach number of rolling-moment and yawing-moment derivatives for the configurations tested; $R/ft=2.0\times10^6$.

[redacted]

 [redacted]

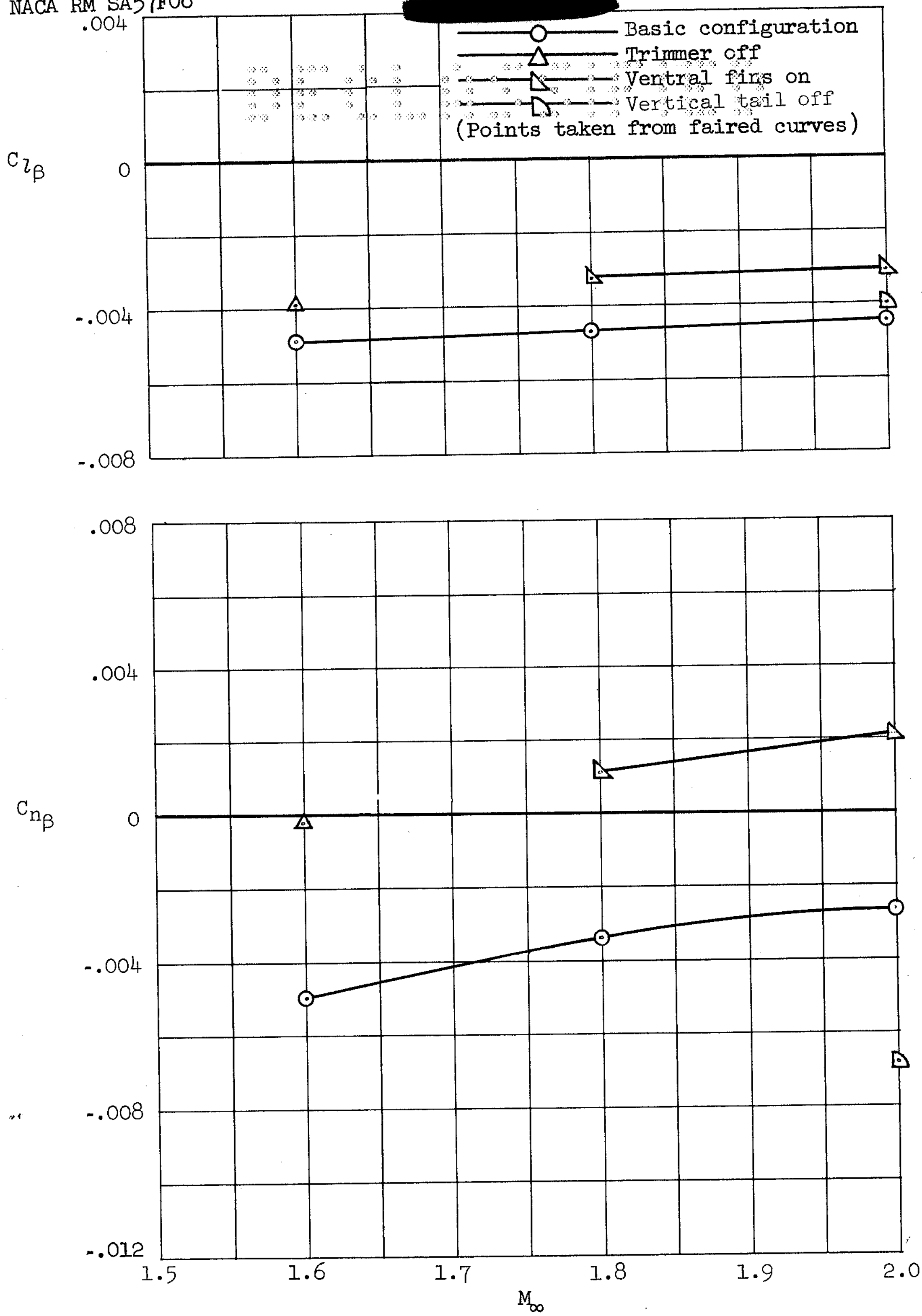


(b) α=5.5°

Figure 10.- Continued.

[redacted]

 [redacted]

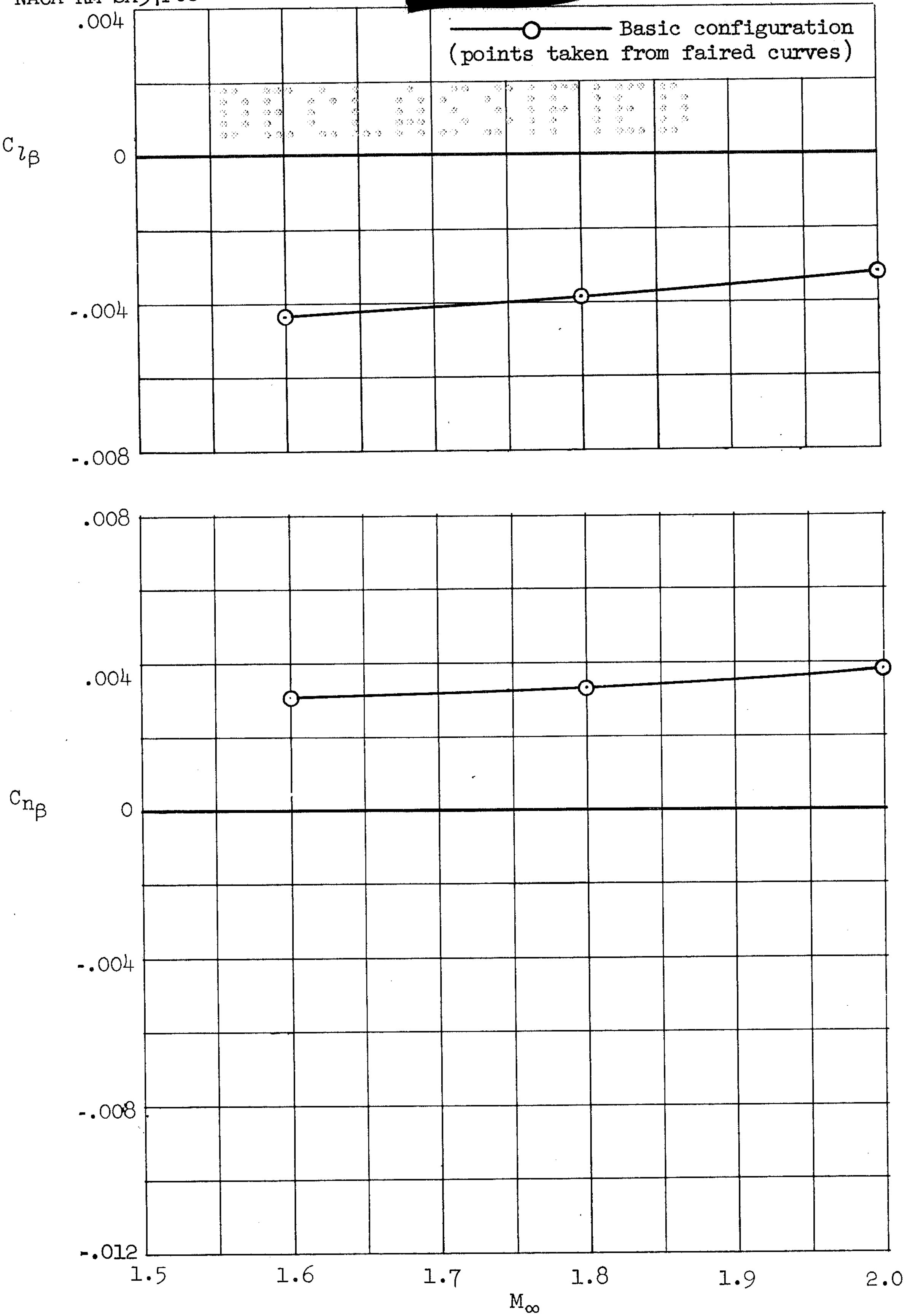


(c) $\alpha=11^{\circ}$

Figure 10.- Continued.

[redacted]

[redacted]



(d) α=-5.5°

Figure 10.- Concluded.

[redacted]

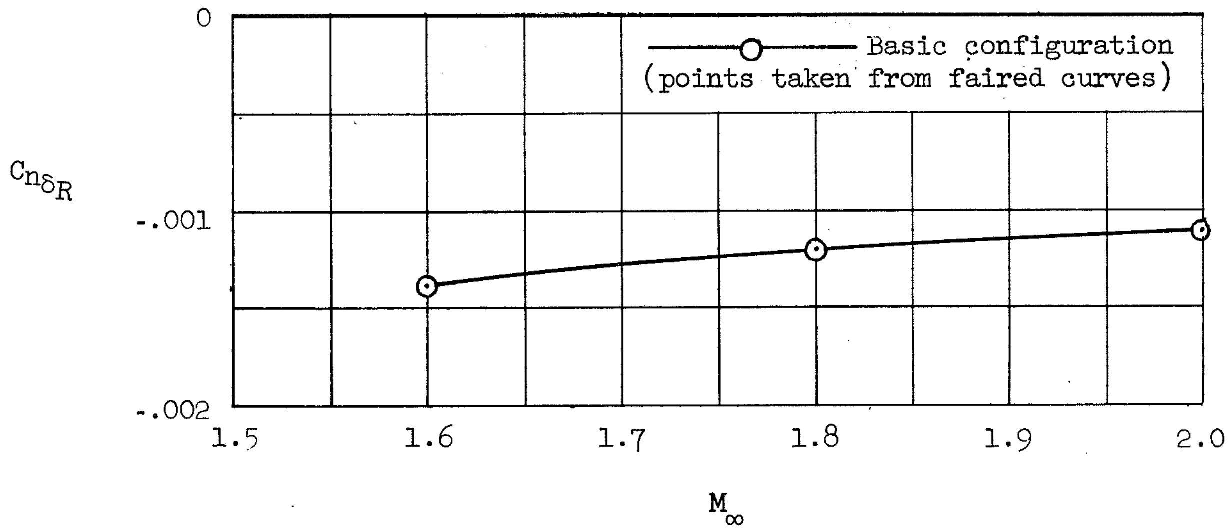


Figure 11.- Variation with Mach number of rudder effectiveness; $R/ft=2.0\times10^6$, $\alpha=0^\circ$, $\beta=0^\circ$